

**Urban
Landscape
Survey in Italy
and the**

**Urban Landscape
Survey in Italy
the Mediterranean
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URBAN LANDSCAPE SURVEY IN ITALY AND THE MEDITERRANEAN

Edited by

Frank Vermeulen, Gert-Jan Burgers, Simon Keay
and Cristina Corsi



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In co-operation with
The British School at Rome
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Koninklijk Nederlands Instituut Rome
Ghent University, Department of Archaeology
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Introduction

Field survey has been making a major contribution to our understanding of the rural landscapes of the Mediterranean for nearly forty years. During that time the techniques used to map ancient settlement patterns have grown in sophistication from being a process of simply identifying sites in the landscape, to one which provided nuanced understandings of their layouts, chronologies and contexts. One consequence of this was the growing realization in the 1980s and 1990s that these same techniques also held out the promise of making a major contribution to our understanding of urban sites, particularly the large towns, cities and ports of the Classical Mediterranean. This was spurred by seminal projects such as the study of Boeotian towns by Bintliff and Snodgrass, as well as by the refinement of geophysical techniques and aerial photography that could be used for the fine-grained analysis required to bring out details of urban layout, and the use of Geographical Information Systems.

The consequence of all these developments has been an upsurge in the non-destructive survey of urban sites, both in Italy and in other parts of the Mediterranean. Archaeologists have been quick to realize the potential offered by this technique. Large and complex urban sites which had hitherto been studied in a piecemeal approach that was largely predicated upon the monument-based interests of earlier scholars were able to use survey techniques to rapidly generate plans of partial, or in some cases, complete townscapes, most notably at such sites as *Falerii Novi*, *Italica*, *Zeugma* and *Aphrodisias*. This has led to a revolution in how archaeologists approach urban sites, with survey techniques being used increasingly often to generate a plan of a town site prior to excavation as a way of ensuring that the excavation can be used to address site-specific questions in a way that had not been possible before. Cultural heritage management authorities have also benefited from this approach, with urban surveys providing them with a very effective tool for gauging the degree of archaeological survival on major urban sites in their care and choosing appropriate conservation strategies. Most recently, research has begun to reveal the advantages of integrating a range of different non-destructive techniques on urban sites, choosing those suites that are most appropriate for the nature of the town in question. In combination with exciting new computer-based means of data visualization, all of this work means that it is now possible to virtually reconstruct a buried town within a relatively short space of time, as opposed to the old and destructive excavation-centered approach that could take generations. Unsurprisingly these advances are starting to make a very important

understanding to urbanism in general and the Roman Empire in particular.

This volume builds upon all these new developments and is indeed one of the first to focus exclusively upon the contribution of survey techniques to our understanding of ancient towns. It arises from two international workshops held in Rome at the British, Belgian and Dutch Schools in 2007 and 2009, whose focus was a methodology led enquiry into the nature of urban settlements primarily in Italy, but also in Greece, Turkey, Croatia, Portugal and Spain. The volume contains some 23 papers from leading specialists in the field, which focus upon two underlying themes. The first deals with the characterization of urban sites and draws upon a wide range of case studies. These range from key protohistoric centres in central and south Italy, to towns that epitomise the contradictions of cultural change under Rome, such as *Paestum*, *Aquinum* and *Sagalassos*, to Roman centers such as Teano, *Suasa* and *Ammaia*. The second theme focuses upon inter-urban relationships, with particular attention to wider urbanized landscapes in Italy.

The volume is not meant to represent the full geographical spread of survey based town research in the Classical world, but aims to present a good selection of recent and on-going projects where excellent integrated survey work significantly moves the limits of our current knowledge about ancient towns, most of which were partly or completely abandoned. Without prejudice to the conclusions reached by the authors of each contribution, or by two specialists who inserted their comments at the end of the volume, the editors would like to stress a few points common to many research projects presented here. One is that many authors propagate quite rightly that a good combination of urban surveys not only significantly enhances the knowledge of the scale, structure and chronology of specific buildings and town sections, but allows now to look at the wider phenomenon of urbanism in a valid and necessary comparative perspective. Furthermore, some contributions emphasise that since (proto-) urbanisation also entails the formation of a dependent countryside, research of rural settlement patterns is also crucial to come to an understanding of this process. This is a plea for wider area approaches and for not limiting the survey zone to just the urban centre. As expected, no any urban study can be considered complete if the town is not framed into its relationship with the whole suburban context and even the wider territory. For many teams ideally, the field surveys should really be part of a holistic approach also encompassing small scale ground-truthing operations, such as test-pitting and focused excavations. And in fact several projects aimed, from the beginning, at an integrated approach, combining field surveys with aerial archaeology, geophysical prospections and excavation. Some authors also warn that the results of the application of one or other technique, such as traditional field walking, proved even to be misleading, considering the very strong biases of post-depositional processes and in particular of soil disturbance. Certain approaches in city surveys are still in an experimental stage and much research still has to be done on methodological

issues, e.g. on sampling strategies and on the study of the effects of post-deposition. However, instead of surrendering to these problems, some teams take such issues as the point of departure for further investigations and develop their site as a laboratory for experimentation in field survey methodology. This allows for further development of an adequate methodology and warns against drawing far reaching interpretations on urban development on the basis of the results of short-term urban survey projects.

The editors wish to express their gratitude to the peer reviewers of all the chapters in this book.

Frank Vermeulen, Gert-Jan Burgers, Simon Keay and Cristina Corsi

PART 1: INTRA-URBAN SURVEY

Intensive On-site Artefact Survey and Proto-urbanization. Case Studies from Central and South Italy

P. Attema and T. de Haas

Introduction

Within the frameworks of the Pontine Region Project (PRP, south Lazio) and the Francavilla Project (FP, northern Calabria), the Groningen Institute of Archaeology (GIA) has carried out a number of on-site artefact surveys in areas where the extent and nature of surface finds show much more than the average pottery scatter characteristic of the isolated farmstead or hamlet (Figure 1.1).¹ The aim of this paper is to discuss the results of these on-site surveys and evaluate their relevance in light of the concept of protourbanization as defined in Italian settlement archaeology.²

Proto-urbanization is a crucial concept in Italian protohistory, describing the social, economic and spatial processes that began in the late Bronze Age and led to the formation of centralized settlement in the Iron Age and Archaic period.³ Leading Italian scholars of the Roman School of Protohistory, whose nestor was the late Renato Peroni, have convincingly shown that the selection of favourable locations in the landscape was an important step in the formation of the proto-urban centres, since settlement in the course of the final stages of the Bronze Age and the Iron Age clustered in such places (Peroni and Trucco 1994; Vanzetti 2004). Survey projects have over the years discovered and studied many of these centralized settlements as well as the rural patterns of land-use related to them (Attema 1993; Burgers 1998; Attema, Burgers and van Leusen 2010).

Research in the Pontine region as well as in the Sibaritide and its hinterland consists of a combination of topographical work in the tradition of the *Forma Italiae*, ongoing excavations of key-sites, environmental studies and intensive field surveys. For both regions this has resulted in detailed knowledge of the long-term evolution of settlement organization confirming the model of the Roman School of Protohistory in which centralization of settlement begins in the final stages of the Bronze Age and in the Early Iron Age. Both in the Pontine region and in the Sibaritide this process of increasing settlement complexity is seen to result in the formation of proto-urban centres, each controlling its own territory (Alessandri 2009; Attema, Burgers and van



Figure 1.1 Location of the study area of the Pontine Region Project in south Lazio and of the International Francavilla Archaeological Project in northern Calabria (Sibaritide).

In the following we first give an overview of the on-site surveys carried out by the PRP (Figure 1.2) at three protohistorical sites in the Pontine Region and by the FP at the site of Timpone della Motta at Francavilla Marittima. This overview, based on field research already carried out in the late 1980s and early 1990s, serves as the starting point for observations on the contribution that on-site surveys of protohistorical centres can make to our understanding of the development of urbanism in Central and South Italy in the protohistorical period.

After discussing the limitations of the data of these case studies in light of

methodological innovations and more recent insights from alternative sources, we then proceed to discuss another case from the Pontine Region, *Satricum*, a site that has been excavated thoroughly. Based on the data from this site, the development of its proto-urban form may be traced in detail and as such, we propose it may provide a possible scenario for the evolution of other less well-known proto-urban centres. Finally, we comment on recent insights from rural surveys and the excavation of specialized industrial sites that furnish new information on the earliest phases of the process of proto-urbanization in both regions.

Case studies from the Pontine Region Project

Caprifico di Cisterna

The protohistoric settlement of Caprifico di Cisterna in the tuff hills southeast of the Colli Albani was first published by Brandizzi Vittucci (1968), and more fully discussed by Melis and Quilici Gigli (1972). They published a reconstruction of the site's geomorphology based on aerial photographs taken before land improvement schemes of the late 1960s, which show the profound impact of these works on the relief in the area. In 1990, the PRP carried out an on-site survey at Caprifico di Cisterna (Attema 1993: chapter ix). The aim of the survey was to establish the chronology of the settlement by mapping changes in the extent of the settlement during the Iron Age and the Archaic period based on dated artefact distribution.⁴ Although extensive and dense pottery concentrations were mapped in the vineyards and kiwi fields in the settlement area, the land improvements had altered the relief to such a degree that a spatial relationship between the distribution of surface pottery and subsurface features must be considered lost. As most of the ceramics date to the Iron Age and Archaic periods, the survey did confirm that the settlement of Caprifico di Cisterna began as a small settlement in the early Iron Age, developing into a large centre in the late seventh and sixth century BC. After this, the site was abandoned.

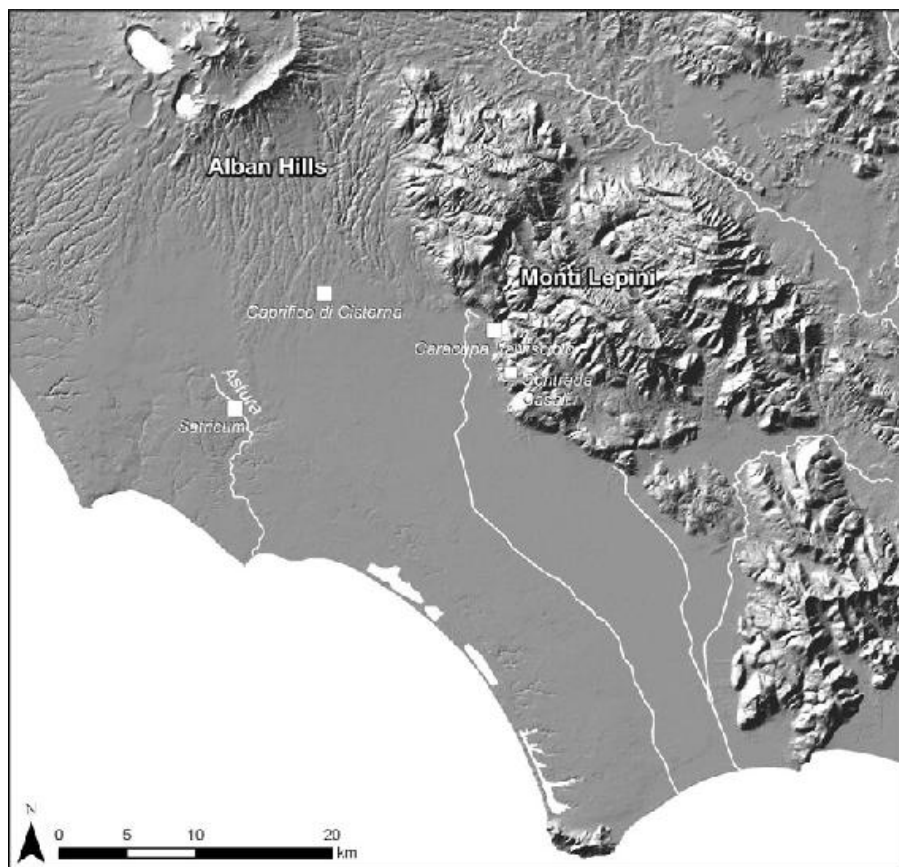


Figure 1.2 Sites in the Pontine region mentioned in the text.

More recently, Lorenzo Quilici (2004) proposed a new reconstruction of the morphology of the settlement based on 1:5000 topographic maps, again made before the land reclamations of the 1930s. Quilici reconstructs an Archaic settlement area of *c.* 37 ha that was both naturally and artificially defended. This reconstruction has important implications for the interpretation of the survey data: Figure 1.3 shows Quilici's reconstruction with the artefact densities recorded during the PRP survey plotted onto it. While the densest pottery spreads fall within the perimeter of the site as defined by Quilici, high densities are also found outside the reconstructed settlement area, particularly to its east. Considering the changes to the landscape, these concentrations do not reflect ancient settlement but rather represent the effects of the more recent levelling activities.

Caracupa/Valvisciolo

The protohistoric site of Caracupa/Valvisciolo, situated on the lower slopes of the Monti Lepini, had already been discovered at the beginning of the twentieth century by the Italian archaeologists Savignoni and Mengarelli.

They recorded a system of polygonal masonry terrace walls, a votive deposit and a number of Iron Age tombs on the slopes of the Monte Carbolino above the abbey of Valvisciolo, as well as an Iron Age cemetery in the area of Caracupa, c. 800 m to the west (Savignoni and Mengarelli 1903; Mengarelli and Paribeni 1909). However, they made no attempt to trace the settlement area. In 1988, a PRP team investigated the alluvial fan between the necropolis and the slopes of Monte Carbolino (Attema 1993: chapter viii).

In this area, traces of habitation were abundant on the surface and an on-site survey was carried out in three freshly planted fruit orchards with dense pottery spreads.⁵ The modest amounts of early Iron Age pottery and the high densities of late seventh- and sixth-century BC potsherds suggest that the settlement of Caracupa/Valvisciolo, just as Caprifico di Cisterna, began as a modest Iron Age settlement and subsequently developed into a sizeable settlement in the Archaic period, after which this site was abandoned as well.⁶ Again using 1:5000 maps of the late 1920s, we may reconstruct the original settlement area, which would have been delimited by a stream to the west and the slopes of the Monte Carbolino to the north and east. This area measures c. 40 ha. As can be seen in Figure 1.4 the surveyed fields are located in the centre of the reconstructed settlement area.

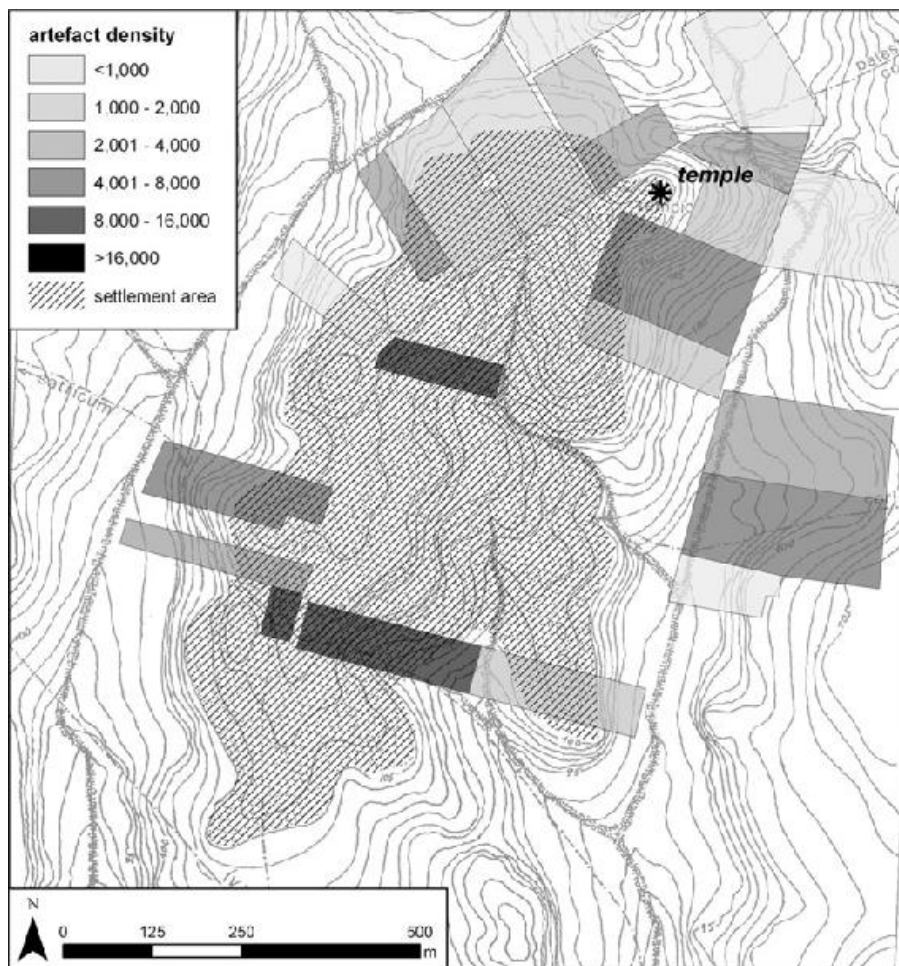


Figure 1.3 Quilici's reconstruction of the settlement at Caprifico di Cisterna with artefact distributions from the PRP survey plotted onto it.

Contrada Casali

A third on-site survey was carried out on the Contrada Casali, a hill top overlooking the Pontine plain c. 3 km southeast from Caracupa/Valvisciolo. The site was discovered by the PRP in 1986 and surveyed in detail in 1988 (Attema 1991; 1993: chapter vii).⁷ In an area of c. 5 ha, various concentrations of late Iron Age and Archaic materials were identified.

The presence of tiles is indicative of substantial structures during the latter period. The aerial photograph in Figure 1.5 shows that, besides the many sub-recent agricultural terraces on the slopes, straight walls also appear at the transition of the plateau to the slope on the western side overlooking the plain. Since they were found in association with Archaic tiles, the most plausible interpretation of these walls would be as foundations of ancient habitations and/or terracing of the slope (Attema 1991; 1993; for a different interpretation

as defensive walls, see Quilici Gigli 2004: 269–271). The scale of the settlement of Contrada Casali and the nature of its remains (habitation debris only) indicates that this site was of a lower order than either Caracupa/Valvisciolo or Caprifico di Cisterna.

Discussion

The on-site artefact surveys of the PRP have given information on the chronology and density of the surface remains of a number of relatively large archaeological sites. However, to reconstruct the extent of the settlement we need cartographic sources as well as additional data on features such as cemeteries, sanctuaries and fortifications in order to evaluate the status of the sites. Judging from their size, as well as the presence of such features, Caprifico di Cisterna and Caracupa/Valvisciolo must have been central places functioning at the apex of the settlement hierarchy during the late Iron Age and Archaic period. Contrada Casali may be taken as a settlement that functioned at a lower level in the settlement hierarchy, and may be characterized as a strategically positioned village. Subsequent surveys of the PRP have focused on the rural landscape and revealed evidence for hamlets and isolated farmsteads in the catchments of the central places. In combination, the on-site and rural survey data furnish an image of a complex Late Iron Age and Archaic settlement system. As alluded to in the introduction, it is thought that settlements such as Caprifico di Cisterna and Caracupa/Valvisciolo functioned as independent proto-urban centres, each controlling a territory of its own. The origins of these centres, both for Caracupa/Valvisciolo and for Caprifico di Cisterna, go back to the Early Iron Age (Alessandri 2009).

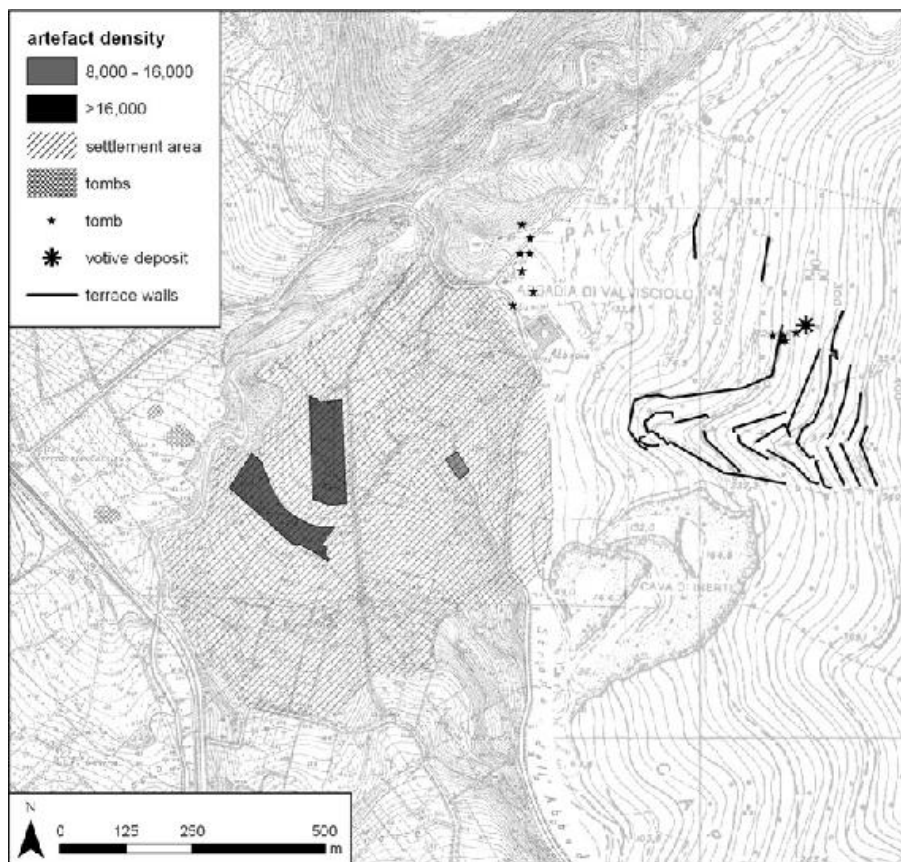


Figure 1.4 Reconstruction by Attema and de Haas of the lower settlement area of Caracupa/Valvisciolo with fields surveyed by the PRP plotted onto it.



Figure 1.5 Air photo of the Contrada Casali with wall remains visible on top of the hill.

A case study from the Sibaritide

Excavations at the site of Timpone della Motta (Figure 1.6) in the Sibaritide (northern Calabria) began in the 1960s, when its Archaic sanctuary and Iron Age cemetery were investigated (see Kleibrink 2006 and AA.VV. 2008 for references). In the 1990s the GIA reopened the excavations of the sanctuary, but also started work on a spacious plateau in the lower part of the settlement (Plateau I). On this plateau, a surface artefact survey was combined with test pits of $1 \times 1\text{m}$ and long test trenches of 0.4m in width as part of the excavation strategy (Attema *et al.* 1997/1998) (Figure 1.7). This procedure resulted in the discovery and subsequent excavation of several features dating to the Bronze and Iron Age as well as a number of Archaic houses. While protohistoric ceramics were found at the surface higher up on the plateau, these did not correlate to any of the Bronze and Iron Age features discovered below the surface, as these were only found on the lower part of the slope during subsequent excavation. This suggests that surface shards found on the higher part of the plateau had been transported down the slope due to erosion.

Lower down on the plateau, Archaic building and slope wash had prevented Iron Age materials from rising to the surface, this in spite of the regular ploughing that had occurred here before the area became part of the archaeological park. At one spot, in the eastern part of the plateau, a clear concentration of Bronze Age materials was observed at the surface, but next to a recently dug pit. More extensive excavation showed that on the lower, flatter part of the plateau a number of Bronze Age and one Iron Age feature were still present at depths of over 1.5m below the surface (Kleibrink 2006: 45–110). From the sections of the trenches it was clear that in various places the original morphology of the plateau had changed significantly by natural and human interference.

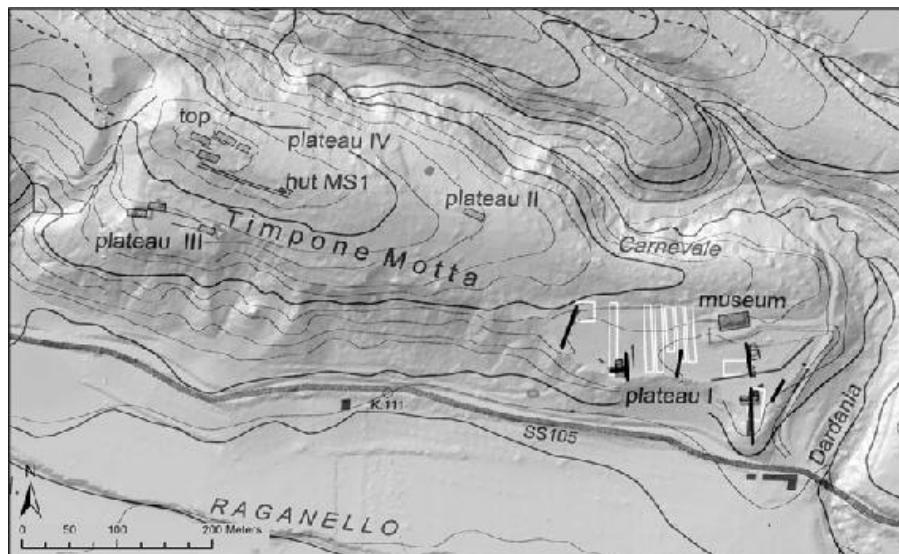


Figure 1.6 Map of Timpone della Motta with survey areas (white boxes) and test trenches (black lines) on Plateau I.

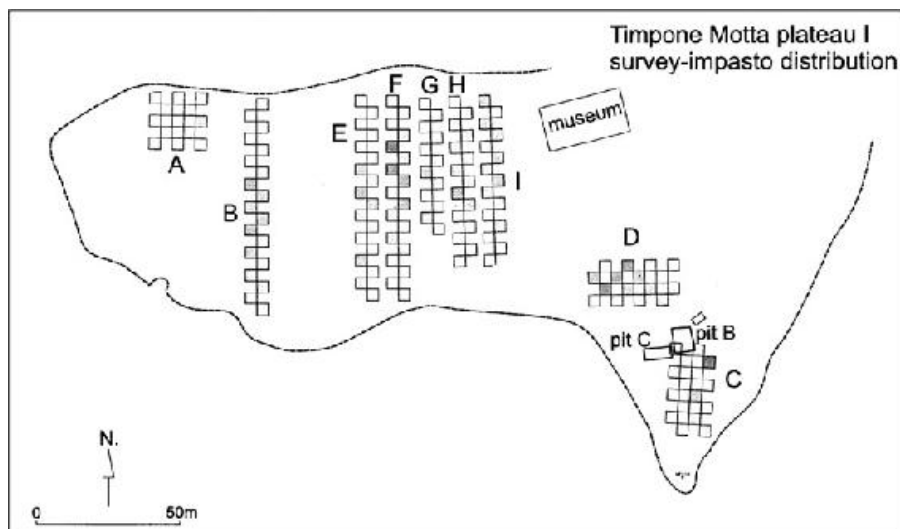


Figure 1.7 Plateau I, units with protohistoric surface artefacts on Plateau I of the Timpone della Motta.

Discussion

Although the intensive survey on Plateau I of the Timpone della Motta gave evidence for protohistoric presence at the site from as early as the Middle Bronze Age, it was only by means of the test trenches that protohistoric features could be localized. On the whole the correlation between the surface record and the subsurface record appeared weak. The investigations also showed that the plateau was never entirely occupied with huts or houses, either during the Bronze and Iron Ages or during the Archaic period. Plenty of space for small scale agricultural activities will have remained between habitations. On a regional level, the recorded protohistoric features fit a much wider pattern of Bronze Age occupation of hilltops, but also of less eminent locations (Attema *et al.* 2010: 100–103). The eighth-century BC occupation of Plateau I represented by a partially-preserved hut proved exceptional from a regional perspective, as pottery scatters of this date have so far not been found in the surrounding landscape. In the Archaic period, houses with cobblestone foundations were constructed on all of the suitable plateaus of the Timpone della Motta, and the site thus grew into a substantial settlement. Before the rise of Sybaris, the site would certainly have stood at the apex of the settlement hierarchy. The similarities with the sites of Caracupa Valvisciolo and Caprifico di Cisterna in the Pontine Region (size of the settlement, the presence of cemeteries and a monumental sanctuary) suggest that it should equally be seen as a proto-urban settlement.

Evaluation of methodology and results

Since the time of execution of the on-site artefact surveys in the late 1980s

and the early 1990s, survey methodology and technology, recording protocols, artefact knowledge and analytical possibilities have improved immensely, while remote sensing methods and access to digital maps and aerial photographs have become much easier and are now within reach of most projects (for a recent example, see Guldager Bilde, Attema and Winther-Jakobsen forthcoming). The PRP and FP have at the time of writing run 23 and 19 years respectively. In this period the methodology has been refined both on the level of survey strategy and ceramic analysis. Moreover our knowledge of the archaeological and historical context of these settlements has been enriched. This demands that the results of earlier surveys and excavations should be evaluated anew to further our understanding of protourbanization from a landscape archaeological perspective.

In the case of Caracupa/Valvisciolo for instance, the maps used for a reconstruction of the settlement area have only become available more recently, giving a much firmer basis for a reconstruction of the settlement. Moreover, continuing research of the surroundings of the settlement has shown that this Iron Age and Archaic settlement was a central element in a complex system that also featured control posts guarding the various routes that connected the interior and ultimately the oriental side of the Monti Lepini with the Pontine plain (van Leusen *et al.* 2003/2004; de Haas 2011). The on-site survey of Contrada Casali proved that contemporary to Caracupa/Valvisciolo there were smaller sites (hamlets, villages), while isolated farmsteads with tile roofs also occur around the settlement.

Similarly, the case of Caprifico di Cisterna shows that solid cartographic data are needed for a correct interpretation of the surface finds, especially where the landscape has undergone major transformations. Moreover, recent in-depth research of Latial terracottas in foreign collections proves that Caprifico di Cisterna boasted a typical Latial temple complex, the remains of which were deliberately destroyed at the time of its discovery in the late 1960s during the levelling of the area (AA.VV. 2006; Lulof 2009; Palombi 2010). Combining the evidence from the survey, the reconstruction of the settled area and the data from the looted artefacts has made it possible to confirm beyond doubt the status of Caprifico di Cisterna as an independent proto-urban centre.

At Francavilla Marittima the on-site artefact survey was valuable as a first step in a field strategy that moved from survey via test pits and test trenches to the excavation of features ranging from the Middle Bronze Age to the Archaic period. The results show that we must exercise caution in inferring a direct relationship between surface and subsurface remains; neither should we assume that settlement areas were always densely built up. Regarding the former, the combination of survey with excavation demonstrated that protohistoric layers at the Timpone della Motta settlement only rise to the surface with activities that go beyond regular ploughing. This observation, certainly not new, shows the limitations of surface artefact surveys as a

diachronic source of information on former habitation (see for example Bispham, Swift and Wolff 2008).

Survey and excavation data and the evolution of proto-urban settlement

The discussion above shows that at Caprifico di Cisterna the surface record is too disturbed to draw conclusions on the extent and density of habitation per period, while at Caracupa/Valvisciolo the survey did not cover a large enough part of the settlement to make any such inferences. But even in cases where the entire settlement has been surveyed, the interpretation of protohistorical surface data remains difficult. For example, at Veii (South Etruria), new investigations and re-interpretations of the Iron Age surface finds have led from the older model of dispersed habitation in various nuclei to the current hypothesis of a spatially contiguous occupation of this vast plateau (Patterson *et al.* 2004: 14/15). Ongoing excavations still help us to more accurately understand the way in which Veii evolved as a proto-urban settlement.

One way to better interpret the evolution of the sites of Caracupa/Valvisciolo and Caprifico di Cisterna, would be to look at potentially similar, excavated settlements in the Pontine region, for which *Satricum* offers a possibility. The excavations at this site carried out at the turn of the nineteenth century by the famous Italian archaeologist Mengarelli in combination with the Dutch excavations from the late 1970s onwards have resulted in the establishment of a sequence of settlement phases from the Early Iron Age to the Archaic period for this site. This sequence may tentatively be taken as a potential scenario for the evolution of other Latial proto-urban centres, be it that most of the archaeological data at *Satricum* stem from the acropolis, and we have little evidence from the wider area of settlement (Maaskant Kleibrink 1987; 1992; Gnade 2007).

The oldest phase of *Satricum* is dated between 830–725 BC in the conventional dating system (Nijboer *et al.* 1999/2000). The settlement in this phase consists of huts possibly organized around a natural depression on the acropolis (Figure 1.8). Some oval huts were interpreted as domestic spaces associated with weaving, while others were identified as cooking areas. Votive pits dating to this period suggest that a cult place already existed on the acropolis. The oldest tombs in the so-called northwest necropolis also date to this period.

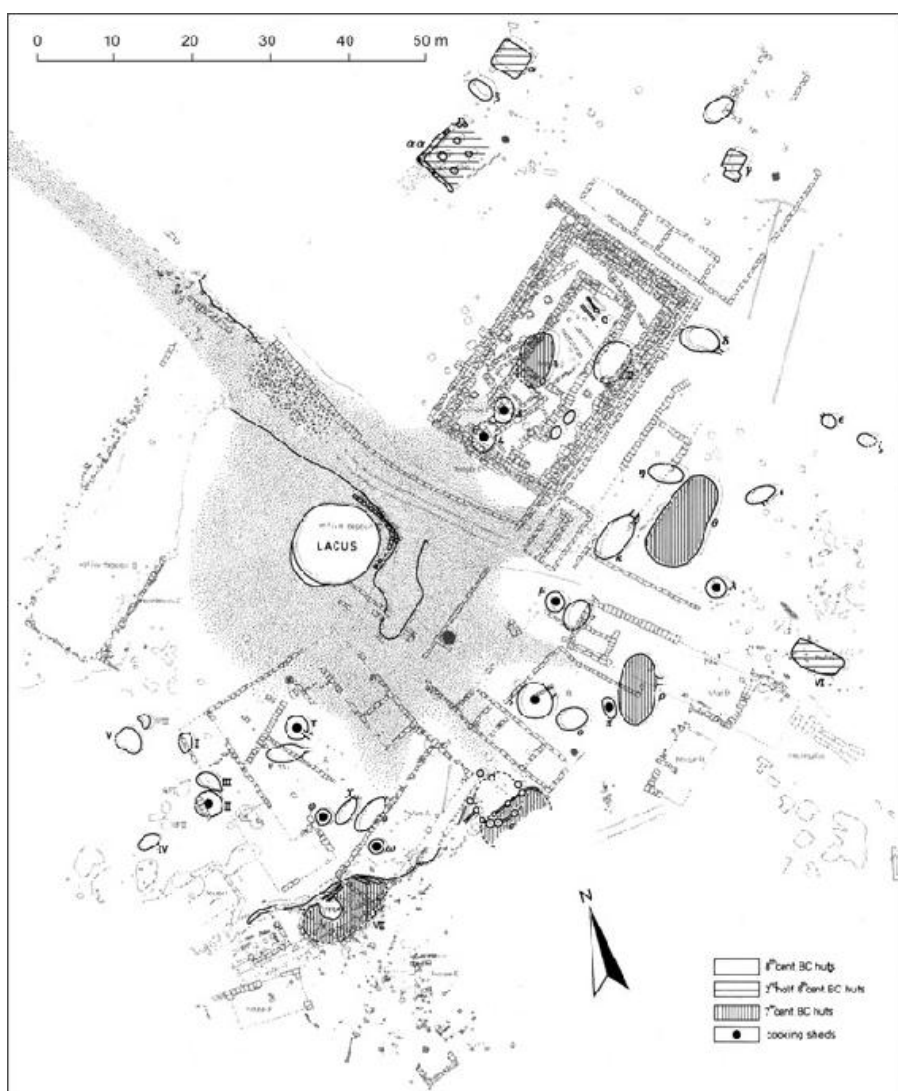


Figure 1.8 Map of huts at ancient Satricum.

In the Early Orientalizing period (725–650 BC), larger huts were constructed, some of which were rectangular in shape. In the Late Orientalizing period (650–590 BC), timber buildings with partly tiled roofs and storage facilities were also constructed besides the large oval huts. While the evidence from ritual and funerary contexts shows continuity, possible settlement remains from the Orientalizing period have also been observed in the lower settlement area (see Gnade 2009: 363).

In the first half of the sixth century BC, the first small rectangular houses with tiled roofs appeared, in some cases decorated with architectural terracottas. Around the middle of the century, the first courtyard houses were built and a monumental temple arose on the spot of the previous cult building

(see Van't Lindenhout 2010). In the Late Archaic period (second half of the sixth century BC), a reorganisation of the settlement and temple complex took place. Based on the surrounding earthworks and general geomorphology, the total surface of the settlement at that point in time is calculated to have been c. 40ha.

The combined evidence of the settlement and the necropoleis, sanctuaries, the evidence for local pottery production, exchange system and subsistence mode suggests a trajectory towards social and economic complexity, which is commonly seen as indicating the transition from a tribal society to an early city state (Cornell 1996; 2000). *Satricum* thus furnishes an evolutionary scenario that may serve for comparison with data from other sites in the region, such as Caprifico di Cisterna and Caracupa/Valvisciolo, that have not been excavated. The evidence from the Archaic period so far suggests that these sites fall in one and the same class at the top of the settlement hierarchy.⁸

Rural settlement data and the origins of proto-urbanization

Whilst earlier in this paper proto-urbanization as a spatial process was defined as nucleation of settlement through a process of selection of specific locations, this does not do justice to the importance of rural settlement data in a study of proto-urbanization, as the evolution of such settlements and the formation of early city states also implies changing relations with the countryside (see also Rich and Wallace Hadrill 1991; Osborne and Cunliffe 2005).

Recent work by the GIA has shown that in order to detect the protohistoric rural landscape a mode of survey is needed that approaches the intensity of on-site surveys.

In the Sibaritide, for example, we found that even field surveys in 50 × 50m blocks with 20% coverage could only reveal glimpses of protohistoric rural occupation of the foothills around the Timpone della Motta. Protohistoric rural sites in most cases showed up as scatters of very few, small and friable shards which needed to be revisited repeatedly in order to collect datable shards. Such small sites will go unnoticed in less fine-grained and less protohistorically sensitive surveys. Over the years this approach has resulted in the identification of a dense pattern of small protohistoric pottery scatters, which date primarily to the later Bronze Age. It is a pattern that raises interesting questions. Are we dealing with a distribution of isolated sites built up over a long period of time, or with a dispersed cluster of more or less contemporaneous sites, or with a mixture of both? And in particular, what relations did these sites have with central settlements?

In this light, scatters containing shards of so-called *dolii cordonati*, large storage vessels of depurated clay, are particularly interesting. These vessels were made using technology developed in the Aegean and were until recently exclusively known from central settlements and therefore taken as indicative

for centralized storage (Peroni and Trucco 1994; Levi and Schiappelli 2004). Their presence on rural sites provisionally dated in the Late Bronze Age, however, indicates that storage facilities also existed in the countryside, and thus furnishes evidence for early socio-economic relationships between countryside and central settlement in the Sibaritide. Rural settlement data thus add a significant dimension to proto-urbanization as a spatial process involving central settlements and the countryside.⁹

Relations between early central settlements and the countryside may also be observed in the coastal area of the Pontine region, where the central settlement of Casale Nuovo has yielded information on Late Bronze Age craft specialization, including metallurgy and pottery production (Alessandri 2009: 198–200 with references). In its vicinity, the GIA excavated a Late Bronze Age salt production site (Attema, de Haas and Nijboer 2003; Nijboer, Attema and van Oortmerssen 2005/2006). The presence of such a specialized industrial site indicates that in the Late Bronze Age a complex economic system was in place which was presumably controlled from central settlements (Alessandri, 2009: 584–587). Intensive survey of the catchment of protourban sites with a keen eye on the protohistoric dimension of the landscape is of great help to further define the role of the central settlements within their territories.

Conclusions

The aim of this paper was to discuss the results of on-site artefact surveys of the PRP and FP that were undertaken in the late 1980s and early 1990s, and evaluate their relevance in the light of the concept of proto-urbanization as defined in Italian settlement archaeology. Although these surveys provide basic information on site chronology, the methodologies applied and the scale of the surveys do not allow a detailed analysis of the evolution of such sites. For example, only recently have reliable geomorphologic reconstructions become available for the sites of Caprifico di Cisterna and Caracupa/Valvisciolo, which had they been accessible at the time of survey would certainly have led to a different survey strategy. Moreover, if the sites discussed were to be surveyed at the moment of writing, geophysical prospection would no doubt have been part of the research strategy. Finally, data on the presence/absence of cemeteries, sanctuaries and fortifications, which are of crucial importance in a study of proto-urbanization, are not always represented in surface contexts, and we thus have to rely on different archaeological data as well.

While for the time being we suggest that the few well-excavated sites such as *Satricum* provide the best cases to study proto-urbanization, on-site surveys using a more integrated approach would certainly be a major contribution to the study of many proto-urban centres and of the process of proto-urbanization in general. Such an integrated approach should include remote

sensing techniques, which although commonly used to study Roman sites (see various contributions to this volume), are only incidentally applied to protohistoric sites.¹⁰ While such techniques offer the possibility to map the structure of a site in detail, the study of the evolution of proto-urban sites still requires methods that give data with more chronological precision, which can only be attained by systematic on-site artefact surveys, test-pitting and at the end of the methodological chain, proper excavation. Such a strategy, on a small scale already applied at Timpone della Motta, may also lead to a better understanding of the relations between surface and subsurface remains.

We also note that, besides in-depth studies of the protourban centres, studies of rural settlement patterns are crucial for our understanding of proto-urbanization, as we still know too little about the relationship between central places, rural settlements and specialized industrial sites. Since the early 1990s when the research discussed in this paper took place, field survey methodology has been considerably enriched, and intensive methods currently in use are especially suited to the study of the protohistoric landscape. The study of protohistoric rural settlement is urgent, as its often fragile record is disappearing at a rapid pace.

Notes

- 1 The Pontine Region Project in south Lazio was initiated in 1987 and is still ongoing (Attema 1993; Attema and van Leusen 2004; Attema, de Haas and Tol 2010). The excavations of the Timpone della Motta at Francavilla Marittima and the on-site and catchment surveys started in 1991 (Attema *et al.* 1997/1998; van Leusen and Attema 2001/2002). Since 2002 the surveys have continued as a separate project, the Raganello Archaeological Project. Recently the surveys, excavations and artefact studies have been combined under the auspices of the International Francavilla Archaeological Project (IFAP, see <http://www.ifap-gia.eu/>).
- 2 This paper is limited to on-site artefact surveys carried out at protohistorical sites. Recent work has concentrated on Roman and Hellenistic sites (see Tol (forthcoming 2010) for the Pontine region and Oome and Attema 2007/2008 for the Sibaritide).
- 3 We have chosen to use the term 'proto-urban centre' for the sites discussed in this paper except for the Contrada Casali. Definitions of city, town and urban centre are notoriously difficult (see Osborne 2005). By 'proto-urban centre', we mean a settlement that stands out as to its population size and density, and economic, political and religious functions.
- 4 In this survey a total area of 2km² was surveyed on and around the site. Agricultural fields were used as collection units and investigated by means of transects covering on average 28% of the surface. Some 30,000 artefacts (total pick-up from the transects) were collected and processed (see Attema 1993: 185).
- 5 Two fields of respectively 0.9ha and 1.2ha were gridded into collection units of c. 60m². A third field of c. 0.3ha was divided into six collection units of c. 200m². In the survey (total pickup) 66,875 artefacts were collected (Attema 1993: 168–177).
- 6 After a period of abandonment, a farm or villa was built in the former settlement area in the Republican period.
- 7 In this survey squares of 16m² were used as collection units. In total 239 squares were investigated yielding a total of 5430 artefacts (Attema 1991).
- 8 However, this does not necessarily mean that these sites would have had the same political status.

- 9 The nature of the distribution of these sites with *dolii cordonati* and their interpretation is currently object of study as part of GIA's Raganello Archaeological Project under the research scheme 'Rural Life in Protohistoric Italy' directed by dr. P. M. van Leusen.
- 10 See the recent work by Frank Vermeulen and his team in the Potenza Valley Survey at the protohistoric site of Montarice in the Marche (Vermeulen *et al.* 2003; 2005) and the on-site surveys in Basilicata of the Scuola di Specializzazione in Archeologia of the Università degli Studi della Basilicata directed by Massimo Osanna at Timmari and S. Maria d'Anglona (<http://www.unibas.it/ssa/attricerca.htm>).

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Urban Landscape Surveys on the Salento Isthmus, Italy

G.-J. Burgers

Introduction

Until some decades ago, archaeological research in Italy was largely limited to ancient towns and to Roman ones in particular. In this context, urban landscape surveys have a long tradition. A site like Pompeii is still overwhelmed annually by numerous international teams seeking to survey the city in one way or another. A major aim of the two workshops on urban landscape surveys central to this volume was to discuss the many methodological advances that have been made in this field of study. But ample attention was also paid to the changes in interpretive approaches that informed the field work. While earlier research was by and large limited to single urban sites and their physical characteristics, in the last three decades interpretive perspectives have widened considerably. This is due to the introduction of non-invasive reconnaissance techniques including intensive field surveys, alongside the excavation of urban sites in the ‘big dig’ tradition. The regional scope of the field surveys makes it possible to focus on the relationship between town and countryside and on the marginal landscapes beyond. Questions can now be asked about the town’s role as economic centre and the spread of market exchange, about the town’s consumer role versus the supply role of the countryside, and about the political and religious relationship between town and countryside. These questions have long been central to the debate on urbanism among historians and, as field surveys are able to monitor long-term trends in the occupational history of a region, archaeology is now finally able to contribute to this debate (cf. Wallace Hadrill 1992). Diachronic regional archaeological surveys have made it possible to study such questions even from a developmental perspective, and to give ample attention to the less visible centralization processes which occurred before the spread of urbanism.

The latter approach is at the heart of the Salento Isthmus Project of the VU University Amsterdam, which is discussed here. This project is focused on the c. 80kmwide stretch of land connecting Italy to its heel, i.e. the Salento peninsula (Figure 2.1). It was started in 1981 to study the territory of Oria, a pre-Roman and Roman town, but it was soon extended thematically,

chronologically and spatially.¹ Now, among the major themes is urbanization, which is investigated as a long term regional process that involved the wider Salento Isthmus landscape as a whole.² To that end, a large series of excavations, field surveys and other non-invasive field work has been carried out in urban, rural and marginal contexts. The surface area systematically investigated covers some 110km² and incorporates environmental zones throughout the Salento Isthmus. Approaches have ranged from urban surveys (Yntema 1993a; Burgers 1998) to total coverage surveys of major urban catchment areas (Boersma, Burgers and Yntema 1989; Yntema 1993b) to transect surveys crosscutting various physiographic units (Burgers, Attema and van Leusen 2003; Burgers and Crielaard 2007; Burgers and Recchia 2009).³ In this article we will largely limit ourselves to a discussion of the non-invasive techniques applied on urban sites.

State of the art

Settlement research in southeast Italian landscapes has gradually awakened from the 1960s onwards, incited by a growing interest in the pre-Roman indigenous societies of the region. The excavations by the archaeological Soprintendenza at the Murge site of Monte Sannace near Gioia del Colle, guided by Scarfi, can be seen as a forerunner of this interest (Figure 2.1). As early as the 1950s, this fortified native site, slightly north of Salento, was investigated by means of extensive open area excavation. Apart from monumental stone structures on the acropolis of the site, large parts of intramural domestic quarters were uncovered by these excavations (see especially Scarfi 1962 and most recently Ciancio, Galeandro e Palmentola 2009). To this day, the Monte Sannace excavations have remained one of the major points of reference for settlement research in native southeastern Italy.

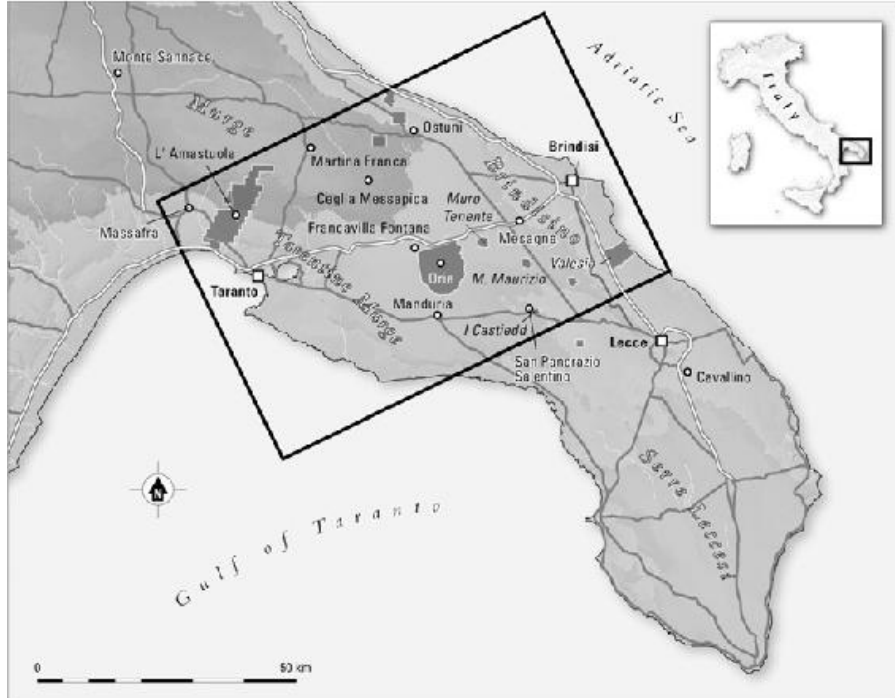


Figure 2.1 The Salento Isthmus research area (outlined) with ACVU survey areas and major archaeological sites.

The same applies to the research at the site of Cavallino, in the heart of the Salento peninsula, carried out by the universities of Lecce and Pisa, in collaboration with the Ecole Française at Rome (Figure 2.1). This research tentatively demonstrated that the site reached a (proto-) urban aspect in the mid-sixth/early fifth century BC (see especially Pancrazzi 1979, and most recently D'Andria 2005). In this phase, a circuit of massive defences was built to enclose a settlement area of 69ha. Parts of this area were built up with blocks of joining houses, flanking paved roads. These houses generally have a rectangular plan, with stone foundations carrying stone or mudbrick walls and tile covered roofs.

The Cavallino excavations encouraged a large series of subsequent investigations at other indigenous sites, involving various international research teams. Among these are the VU University activities in the northern part of Salento. In the context of this project, the decision was taken to extend the settlement research into the countryside and even into marginal areas. As stated, systematic field surveys proved a very useful medium in this regard. Moreover, field survey methods were soon adapted to tackle the (proto-) urban sites discussed above.

The urban surveys carried out in the context of the Salento Isthmus Project

study the sites of Valesio, Muro Tenente, Muro Maurizio and Li Castelli (or *I Castiedd'*) di San Pancrazio Salentino (Figure 2.1). These are among the major indigenous fortified settlements of the Salento peninsula. Originated in the Early Iron Age they reach their maximum extent in the Early Hellenistic period (late fourth–mid-third centuries BC): Muro Maurizio 34ha, Muro Tenente 52ha (Figure 2.2), Li Castelli di San Pancrazio 57ha (?) and Valesio 83ha. Smaller fortified sites were also investigated, such as the Archaic hilltop settlement at L'Amastuola c. 3.3ha (Figure 2.3; Burgers and Crielaard 2007).



Figure 2.2 The landscape of the fortified site of Muro Tenente, municipality of Mesagne (prov. of Brindisi).



Figure 2.3 The fortified hilltop site of L'Amastuola, municipality of Crispiano (TA).

The decision to incorporate such sites into the regional survey project parallels various other larger regional projects in the Mediterranean. Although such settlement areas have been avoided in the past, during the last decade a growing number have been subjected to intensive field walking projects. It is becoming increasingly clear that these surveys can provide information on the diachronic and synchronic differentiation in settlement size, layout, density and zonation of activities. These are also the central questions of the urban surveys discussed here.

Methodology

The answers to the above questions cannot be found directly in the archaeological debris. First, potential biases in the recording of the debris must be assessed. The recording procedures involve the identification, documentation and classification of (sets of) materials which are considered relevant to the central questions of the survey. In many early systematic regional survey projects in the Mediterranean focussing on the detection of rural settlements, this surface debris has been interpreted and recorded in terms of 'sites'. Sites were considered as concentrations of surface materials, being distinguished from their background on the basis of a number of criteria established a priori (mainly involving size and density). These sites were delineated in the field and subsequently plotted as single dots on a map of the survey area.

However, site definition has become more of a problem since most recent survey projects have adopted wider diachronic and synchronic perspectives

(e.g. Cherry, Davis and Mantzourani 1991; Alcock, Cherry and Davis 1994; Francovich, Patterson and Barker 2000). The aims of these projects have shifted from the location of rural settlements towards the identification of a wide variety of human activities throughout the ages. Consequently, attention is increasingly paid to surface debris which does not fit any definition of a 'site'. To cope with this problem, terms such as 'backgroundnoise' and 'off-or non-site' have been introduced to indicate the low density spread of artefacts found around sites.

At the same time, the increasing focus on diachronic and synchronic variability leads to the conclusion that the procedure of delineating a surface concentration as a closed entity hampers an evaluation of the qualitative and quantitative differentiation of the debris. For instance, the in-field delineation and subsequent analysis of a Roman site as a closed entity carries the problem of how to accurately document the variability in distribution and density of artefact classes which could also be present from other periods. Even in the case of research dealing with one period problems arise, considering, among other problems, that artefact densities are extremely discontinuous not only in non-site areas, but also at 'sites' and in concentrations within them; in our urban survey areas, densities vary constantly from <1–75 items per m² over an area of dozens of hectares. In fact, 'in-field' interpretation in single closed entities is fairly impossible in such cases.

In view of the above, we have refrained from in-field interpretations of the surface debris in terms of sites, concentrations or scatters. Instead, in order to maximize the possibility of control we have developed a survey method that minimizes the first level of in-field interpretation. This entails that the surface debris is confronted in the field as a spatial and temporal continuum. It is only after the recording of the qualitative and quantitative characteristics of the debris that we can try to identify the anomalies in this continuum in order to reconstruct the cultural and natural processes responsible for the formation of the debris.

The present day agricultural plots of the target areas constituted the basic research units of the field surveys. They are generally small and bordered by stone walls limiting the distribution of the surface materials. They were field surveyed in a standardized method, in gridded units of approximately 25 × 25m at regular intervals (Figure 2.4). Within these units all artefacts but tiles were collected. At the same time changes in finds densities were constantly signalled and mapped as density contour lines. The finds collected during the surveys were sorted, weighed and counted after washing and drying, then passed to lithic, protohistoric, and classical material specialists for more detailed classification; these data were then stored in a database system (MS-Access) attached to a GIS (GRASS) containing the digitised field maps.

The raw counts and weights resulting from the survey in themselves cannot easily be interpreted because the collection units themselves may vary in surface area, finds visibility, and surface percentage covered. The results

are therefore presented in the form of density distribution maps corrected for unit area and aggregate finds visibility (Figure 2.4). Raw counts per unit were transformed into normalised densities (counts per hectare) by calculating the true surveyed area of each unit (excluding landscape features such as paths and verges, which can occupy a large part of the area of a unit) in the GIS, and dividing the raw counts by the recorded percent coverage and the true unit area in hectares. An aggregate visibility estimate on a 6-point ordinal scale, based on tillage, vegetation, weathering, and stoniness, is recorded in the field for each collection unit. In order to quantify the effect of this visibility estimate, each of the points on the scale was assigned a percentage value based on our estimate of its relative significance.

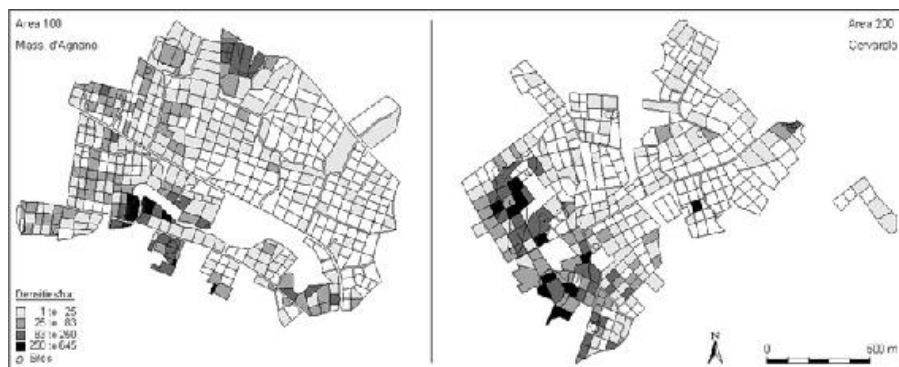


Figure 2.4 Corrected density distribution maps of impasto pottery sherds in the Ostuni survey areas.

The surveys could be supplemented by a range of other archaeological data, extracted from archives and museum research and from publications of sporadic find reports and incidental forms of field walking, such as those inventoried by Lorenzo Quilici and Stefania Quilici-Gigli in the Brindisino (Quilici and Quilici-Gigli 1975). Moreover, they were tested by augering, geophysical research (Figure 2.5), satellite image analysis (Figure 2.6) and excavation (Figure 2.7).⁴

Results

Leaving aside their prehistoric occupation phases, the urban sites surveyed in the context of the Salento Isthmus Project can be shown to have started in the early Iron Age, in the course of the eighth century BC, and to have been continuously occupied until the Roman Imperial period. Starting with the Iron Age sites, these are all of a dispersed type. They consist of various small artefact clusters, separated from each other by an average distance of some 100m and covering a total settlement area of 15–30ha. The emergence of these sites in the eighth century BC confirms earlier analyses that record a sharp rise in site numbers during the later eighth century BC (D'Andria 1991:

405; Burgers 1998: 186–189). Moreover, these finds also suggest that both the inland and coastal landscapes in between preexisting sites were gradually filled in.

The Salento Isthmus Project surveys indicate that most landscape units were already reclaimed in the Iron Age, and that the transition from the Iron Age to the Archaic period was not marked by the founding of new sites, villages or farms. In addition to demonstrating a basic continuity in site pattern, the surveys suggest that the settlement hierarchy that had developed in the course of the eighth to seventh centuries BC stabilized in the Archaic period. Only towards the Early Hellenistic period, the late fourth–midthird century BC, can major transformations in settlement patterns be discerned.

In all urban areas surveyed in the context of the present project, Early Hellenistic artefacts far outnumber any other materials. Moreover, the number of artefact concentrations and the surface they cover are much larger than those of other phases. Previously occupied clusters have in some cases doubled in extent, whereas various other concentrations can be pinpointed which have not produced any earlier materials. In short, we can safely conclude that the surface debris of Hellenistic times is by far the most extensive and dense in all urban survey areas. These data are congruent with the current impression of a process of settlement expansion in Early Hellenistic Salento, based thus far on a limited number of (mostly small scale) excavations.

The analysis of the Early Hellenistic survey data reveals, in addition to a clear tendency towards settlement expansion, the emergence of a hierarchy in urban site extensions. If this hierarchy is extended to rural sites, the pattern becomes even more diversified. The lowest category consists of rural sites measuring a mere 500m² on average. In this respect, the fieldwork carried out in the context of the Salento Isthmus Project confirms the data on such small isolated sites from other southern Italian surveys. Whereas such small, isolated sites are still virtually absent in the Archaic/Classical period, in the Early Hellenistic survey areas a sudden rise in their quantity can be recognized. Between the late fourth and the mid-third centuries BC the larger part of the landscapes surrounding the major settlements was filled in with rural sites of some kind.

Major transformations once again occur in the Late Republican period. In the course of the second century BC, three of the urban sites surveyed, Valesio, Muro Maurizio and Li Castelli di San Pancrazio Salentino, seem to have dwindled into small hamlets. The same goes for approximately half of the farm sites in the countryside of Valesio. The apparent general depopulation of these areas contrasts with the contemporary boom of Brindisi, as well as with the relative continuity of occupation in the coastal area north of Brindisi and in the Oria survey area. Continuity of occupation has also been established for such major sites as Mesagne and Muro Tenente, between Brindisi and Oria. Taken together this suggests that, whereas in the preceding

centuries the larger part of the study region was more or less equally favoured, in the late Republican period settlement concentrated in the northern periphery of the Brindisino and along the axis Oria-Brindisi, on which at least as early as the second century BC the Romans constructed the *Via Appia*.

The Roman Imperial period, instead, is characterized by a considerable degree of abandonment. Two of the four urban sites surveyed, Muro Tenente and Li Castelli di San Pancrazio Salentino, continue only into the first century AD and the other two to within the late Roman period. For all of them, however, the occupation areas are much reduced in comparison to earlier phases.

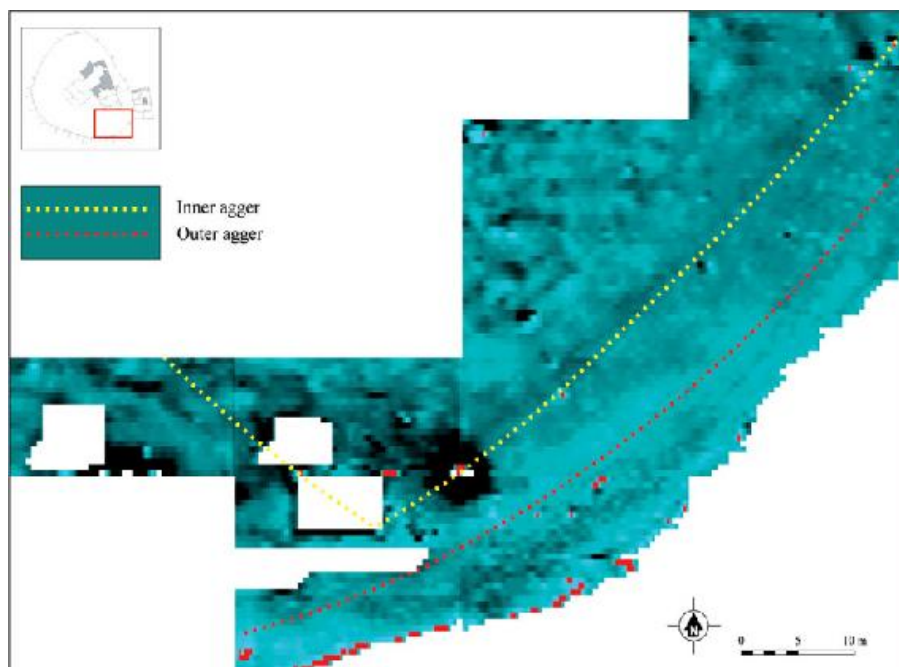


Figure 2.5 Results of the magnetometer survey on the south terrace of the site of L'Amastuola, municipality of Crispiano (TA), showing inner and outer agger.

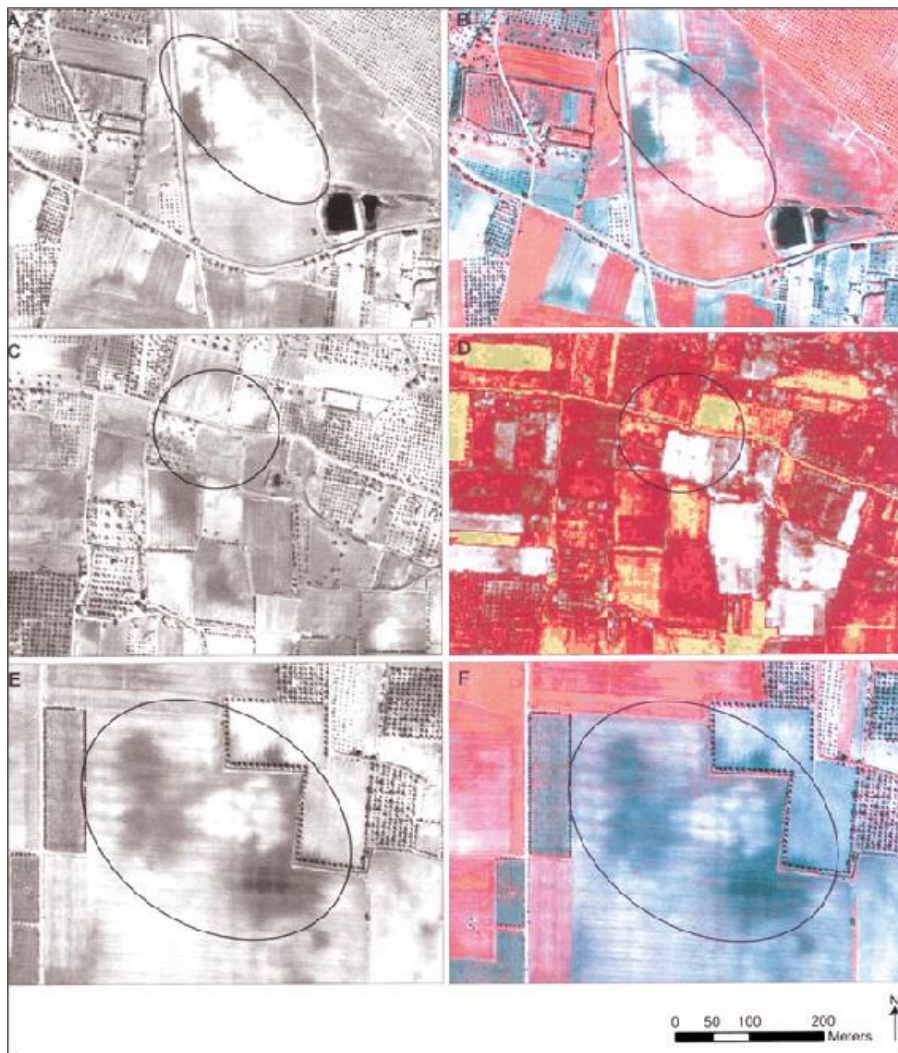


Figure 2.6 Features detected in the satellite image of the environs of the site of L'Amastuola, Crispiano (TA). Left column is panchromatic. B) and F) are multispectral (4-1-2 band combination); D) is a Normalized Difference Vegetation Index (NDVI); A–B) Rectilinear feature, confirmed by field survey as a Hellenistic-Roman site; C–D) Grid pattern, only visible in the 4-1-2 band combination and the NDVI reproduced here. Confirmed by field survey as a Hellenistic-Roman site; E–F) Rectilinear feature, perhaps indicating a buried structure (ground cover prevented confirmation). (From Ross, Sobotkova and Burgers 2009, figure 4).

Conclusions

Without doubt the reconnaissance work done in the context of the Salento Isthmus Project has been highly efficient in detecting sites and structures. In doing so it is of great value to the study of ancient urbanism. However, at this point it is necessary to elaborate on the historical conclusions that can be

drawn from the data produced. In most regional projects, final conclusions are commonly reached from a functionalist-processual perspective. This approach has also informed the Salento Isthmus Project in its initial phases. More recently, however, a contextual, interpretive approach has been adopted, which has considerably changed our interpretations in some cases. I will demonstrate this with an example regarding the pre-Roman period.

Thanks to the refined methods adopted with our surveys, we have been able to show that pre-Roman occupation was much more intensive and diverse than was thought. For these periods it is now even possible to detect shifts in artefact and site densities in rural as well as urban areas. One of these shifts regards the Early Hellenistic period, for which we have attested a significant increase in the total number of surface finds and sites in general and also in the extent of existing sites. Of course, detecting such a shift is one thing, interpretation is another. A functionalist interpretation is close at hand. From the moment it was detected, others have read it in terms of a 1:1 relationship with a population shift, indeed with a demographic rise. In this sense our urban surveys were taken to confirm theories deduced from excavated necropoleis. The number and extent of these also increase notably in this phase.



Figure 2.7 ACVU-excavations at the fortified site of Muro Tenente, confirming the field survey results that suggested the presence of ruins of an Early Hellenistic domestic quarter in the subsoil.

With ever more detailed survey methods, similar shifts in density and distribution of urban site scatters are increasingly being discovered all over the Mediterranean. So far, explanations in demographic terms have proved to be most popular. As a matter of fact, few projects have gone beyond. However, I think that Salento is a case in point to warn us to consider a more contextual, interpretive approach of the survey data. Crucial in this are the urban necropoleis just mentioned. In our urban surveys they can be recognized as distinct assemblages of funerary wares as red figured, *Gnathia* and specific black gloss wares. Both surveys and digs indicate that the extent and density of these burial areas rose strongly in the early Hellenistic period. However, I hold that this is not so much an indicator of demographic change but rather should be read in the light of funerary practices and related social

structures. In this respect, it is generally accepted that in Salento, during the Iron Age, the dead were disposed of in archaeologically untraceable rituals. We do not know of a single burial in this phase. Formal burials, like these, did not emerge until the sixth century BC. For a long time, however, it may have occurred in such small numbers that we can only conclude that large segments of the local populations continued to be buried with traditional invisible rites. Seen from this perspective one can read the rise in burials in the early Hellenistic period to mean that larger parts of the populations started to bury formally, abandoning their previous archaeologically invisible funerary rites. What we are witnessing then is not so much a demographic issue, but one of visibility, of funerary rites in relation to social strategies; access to formal burials now widened considerably.

Social strategies can also account for the strong rise in numbers of Hellenistic black gloss wares detected by the urban surveys. Most commonly they are found in typical household assemblages. If we are to interpret the increase in numbers and density of these assemblages, it has to be emphasized that in the pre-Hellenistic period black gloss wares were imported, mainly from the Greek colonies along the Ionian coasts. In contrast, from the late fourth century BC pottery workshops in most local towns also started to produce black gloss in large amounts, as is indicated by the seriation matrix of all diagnostic pottery forms produced in most Salento towns in relation to their dating (Figure 2.8). We see that from the second half of the fourth century the number of forms increases strongly. Most of them are black gloss. Clearly, to the local inhabitants access to these wares was greatly enhanced. Consuming black gloss became one way of emulating the upper social strata, who had access to these wares much earlier (cf. Millett 1991).

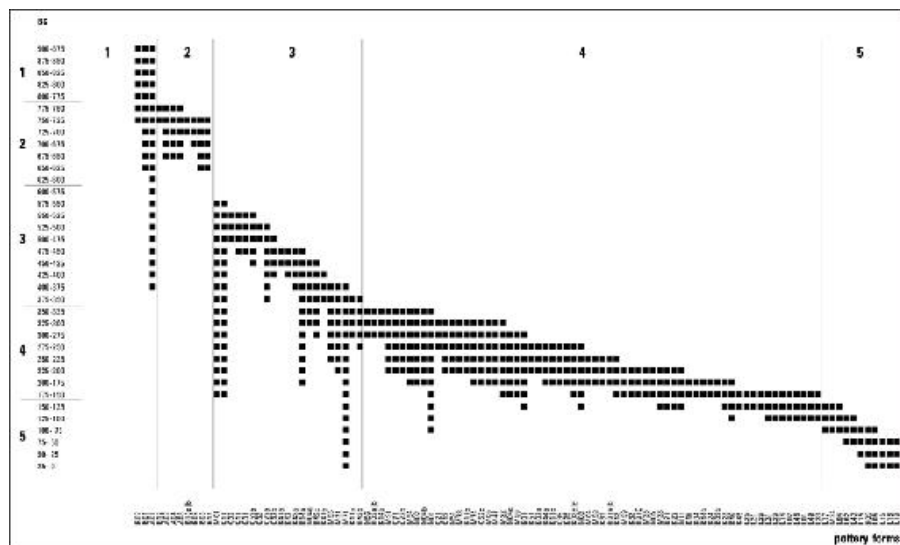


Figure 2.8 Seriation matrix of first appearances of pottery forms on the Salento peninsula (from Mater 2005: 60, table 13).

Similar and sometimes conflicting social strategies of various social groups can explain the appearance of other new elements in the urban landscapes of Salento. This, of course, also holds for other central and southern Italian regions, where rather similar elements are introduced in the Early Hellenistic period; black gloss and other ceramics, urban housing, graveyards and fortifications, and even rural structures, all increasingly adhere to common schemes. From a Classical Archaeological perspective, this increased uniformity has been explained in terms of Hellenization, that is, as a sign of the success of the diffusion of urban, Hellenic high culture. Instead, I would like to interpret this cultural *koiné* as an index of the intensity of cross-regional networks and to identify social strategies within local indigenous communities aiming to exploit these networks and to appropriate new cultural elements, be they material or conceptual. Clearly, this explanation of our urban landscapes differs not only from the Classical perspective, but also from the demographic explanations that I have discussed before. I hold that it is the challenge to urban landscape archaeologists to explore more fully such contextual explanations.

Notes

- 1 The project, started by Douwe Yntema and Johannes Boersma, was originally called the Brindisino Project, as it was concentrated on the province of Brindisi, the eastern half of the Salento Isthmus. When the present author joined it in 1992, its focus was expanded to include the entire Salento Isthmus and it was renamed accordingly.
- 2 From 1997 to 2003 the project was part of the so-called *Regional Pathways to Complexity Project*, a joint initiative of the VU University, the Groningen Institute of Archaeology and the Netherlands Organisation for Scientific Research (NWO), aiming a comparative investigation of ancient urbanization and colonization. See especially Attema *et al.* 2002; Attema, Burgers, van Leusen 2011.
- 3 These latter surveys were conducted in the context of the so-called Murge Tableland Project, a collaboration of the VU University, the Royal Netherlands Institute at Rome, the *Scuola di Specializzazione in Archeologia 'Dinu Adamesteanu'* of the *Università del Salento* and the *Università degli Studi di Foggia*.
- 4 Excavations were carried out at Valesio (Boersma and Yntema 1987; Boersma 1995), Muro Tenente (van Alberda *et al.* 1999; Burgers and Napolitano 2010) and Li Castelli di San Pancrazio Salentino (Maruggi and Burgers 2001; Burgers and Waagen 2009). In 2007 and 2008 in the context of the Salento Isthmus Project, Shawn Ross (University of New South Wales, Sydney) and Adela Sobotkova (University of Michigan, Ann Arbor) conducted an analysis of high resolution multispectral satellite imagery in an area of 100km², centered on the site of L'Amastuola, some 15km north of Taranto (Ross, Sobotkova and Burgers 2009). The aim was to test the effectiveness of this type of remote sensing technique for investigation and management of large, archaeologically rich landscapes. Combining the evaluation of the imagery with concurrent ground control led to the conclusion that, although a fair number of the sites detected in this way turned out to reflect geological features, the success rate of the remote sensing was too high to be explained by random association.

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Amiternum and the Upper Aterno Valley:
Approaching a Sabine-Roman Town and its Territory

M. Heinzelmann and D. Jordan

Introduction

The Roman town of *Amiternum* is situated c. 10km north of L'Aquila in the upper Aterno valley and in the heart of the Abruzzo (Figure 3.1). It has, since 2006, been the subject of a multi-disciplinary urban research project, led by the Institute of Archaeology of Cologne University (Heinzelmann, Jordan 2007; 2009; Heinzelmann *et al.* 2010). Cooperating partners are the Soprintendenza Archaeologica per l'Abruzzo, the University of Berne (Institute of Archaeology and Institute of Geological Sciences) and the University of Mainz (Institute of Geosciences). It is supported by funding from the Swiss National Science Foundation. From 2006 to 2010 a five-week campaign (survey, geophysical prospection and excavation) was carried out in August each year. Geophysical survey was also carried out in the spring because of the summer drought. The campaigns also served as a training project for students. Five or six scientific specialists, conservators and around 20 students were able to take part in each summer campaign.

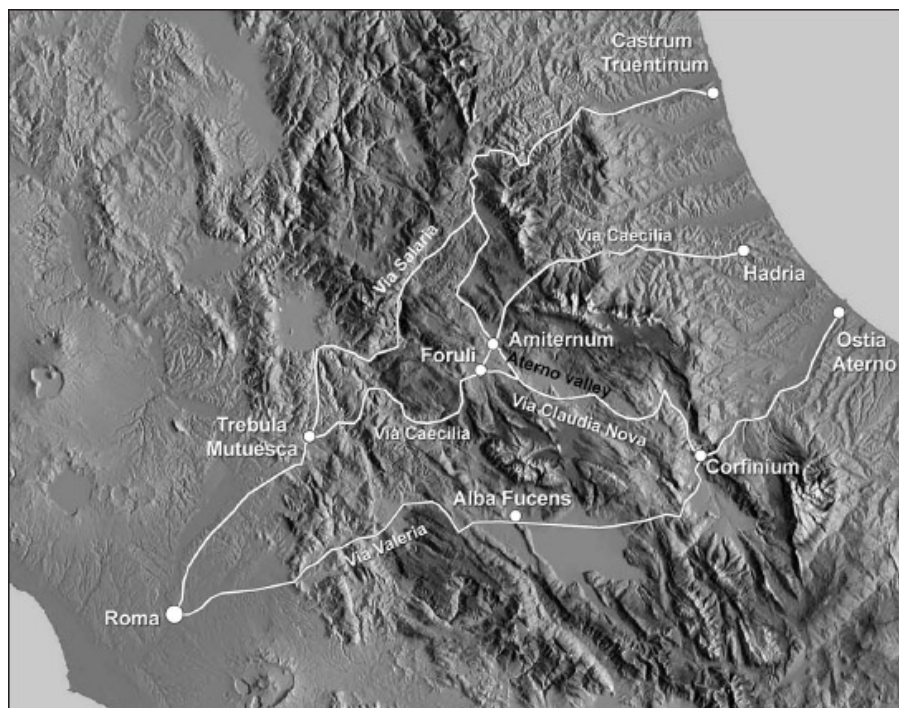


Figure 3.1 Relief map of central Italy with Roman roads.

Current knowledge

Topography of the site

Amiternum lies in the upper valley of the Aterno river, which is bordered to the east by the steep mountain ranges of the Gran Sasso d'Italia (2914m) and to the southwest by Monte Sirente (2349m). The valley is divided into different settlement clusters, of which the most northerly had *Amiternum* at its centre (Figure 3.2). *Amiternum* controlled a broad territory of c. 50km², which covered an approximate triangle connecting the modern towns of Pizzoli, L'Aquila and Civitatomassa. The valley floor still provides the region with fertile agricultural land, the productivity of which is only limited by the harsh climactic conditions (the average altitude of the valley floor is 650–700m above sea level). It is bounded by mountains, drained by small side valleys, with steep slopes which have been adapted in places for agriculture by the construction of terraces, most of which have now reverted to woodland.

Within the territory of *Amiternum* were independent settlements, of which the most significant was the *vicus Foruli* (modern Civitatomassa) to the southwest. Two further *vici*, Preturo and *Pitinum*, lie buried beneath modern settlements. It appears that in Roman times the valley was densely settled with farms and villas. *Amiternum* occupied a strategic location at the narrowest part of the upper Aterno Valley near the modern village of San Vittorino. It

appears that the earliest phase of the ancient settlement developed on an easily defensible plateau, 50–80m above the valley floor, on the site of the modern village. In the course of the late Republic it was relocated to the valley west of the earlier site and the whole area between the two mountain sides to east and west was occupied.

The Aterno Valley was, from the earliest times, an important route for traffic between the Tyrrhenian and Adriatic coasts, between which several highways were constructed after the Roman conquest of c. 300 BC (Segenni 1985: 103–113; Zenodocchio 2008: 117–149). The oldest east–west connection through the area is the *Via Caecilia*, which runs in a straight line through the upper Aterno Valley between *Foruli* and *Amiternum* and formed an important line of communication between Rome and *Hadria*. On the other hand the Aterno Valley together with the Valle Peligna to the south forms the longest continuous route through the central Abruzzo. The valley was therefore of strategic importance as an alternative to the western coastal plain as may have been demonstrated by the successful campaign by Hannibal in 211 BC (Segenni 1985: 54–55). At the same time this accessibility facilitated the annual cattle drive which took place each spring from Apulia, through the lower and middle Aterno Valley to *Amiternum*, as is discussed in detail below.

Former research on Amiternum

The ruins of the amphitheatre at *Amiternum* have always been visible and were therefore used as a quarry for building materials until the end of the Middle Ages. The first proper excavations can be ascribed to the 1830s (Segenni 1985: 136–140). Reliable records of this time are scarce and therefore accurately locating these excavations is seldom possible. Apart from at the necropolis, it seems that digs were carried out north of the amphitheatre and at the theatre. Numerous finds from this time found their way into the international art trade. With the founding of the Italian state and the gradual construction of an appropriate administrative body for the protection of monuments, the uncontrolled digging in and around *Amiternum* was reined in and replaced by more carefully planned and executed excavations. One of the earliest and most extensive excavation campaigns was carried out during 1878 and 1879 completely unearthing the theatre, which is situated in the north of *Amiternum* (Leonsini 1878: 39–40; 1879, 145–147; 181–182; Ausiello 1880: 290–296; 350–352; 379–382). From this time more and more information appeared, describing new finds in *Amiternum* and the nearby sites of Pizzoli, *Foruli*, Preturo and Coppito (Segenni 1985: 264–267). More recently, many emergency excavations since WWII have resulted in additional insight into the area. Particularly informative is the work of S. Segenni, published in 1985, which offered the first summary overview of the older historical, epigraphic and archaeological research regarding *Amiternum* (Segenni 1985). It was followed by further intensive studies of the epigraphical evidence (Segenni 1992). However, our knowledge of the urban structure of *Amiternum* is still in

its infancy.

General historical knowledge

The centre of the Abruzzo was settled by various Umbro-Oscan speaking mountain people by the eighth or seventh century BC at the latest. Ancient sources placed the original territory of the Sabini in the northern Aterno Valley, from where they are believed to have spread gradually westwards during the course of the sixth century BC to the borders of Latium (Poucet 1972: 48–135). Dionysios of Halikarnossos (I, 14, 6 and II, 49, 2) named the original main settlement of the Sabines a so far unidentified place called *Testruna*, which he supposed to have been situated somewhere near *Amiternum*. The original settlement or *oppidum* was thought to be on the hill ridge at S. Vittorino, but so far no firm evidence has been found (Dion. Hal. II, 49, 2; Segenni 1985: 50–52; Coarelli and La Regina 1984: 19). Despite this, indications are increasing that an Iron Age settlement could have existed in the area around the later Roman city. Known since the nineteenth century are the so-called Murata del Diavolo: remains of several unusually monumental cobweb masonry terraced walls that are located at the end of a deeply cut gorge on the southern slopes of Colle Busci, approximately 2km east of *Amiternum* (Segenni 1985: 229–232). 2007, as a result of rescue excavations of the Soprintendenza at Pizzoli, c. 2.5km northwest of *Amiternum*, Iron Age graves were discovered proving the existence of a nearby settlement.

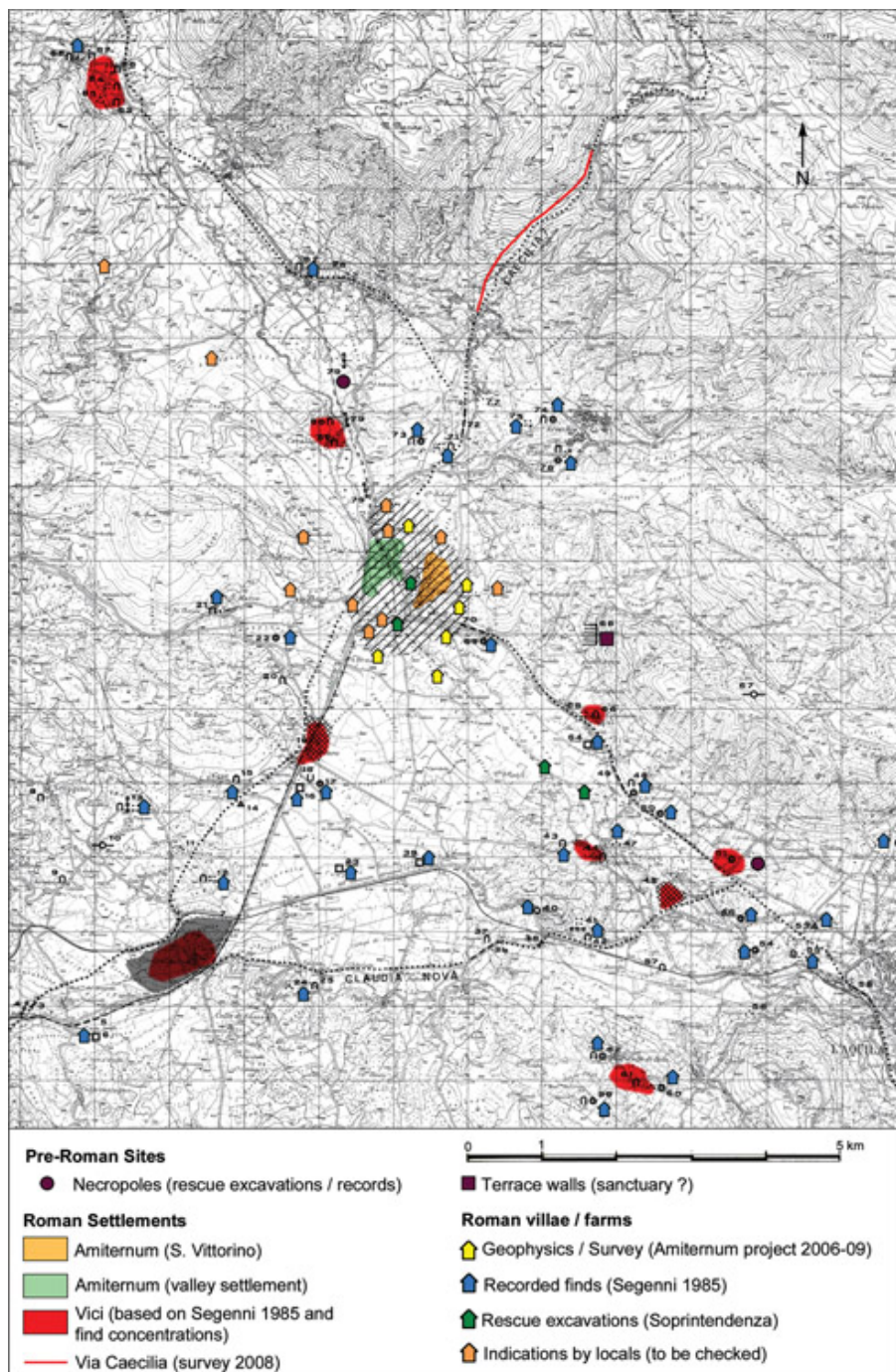


Figure 3.2 General plan of the upper Aterno valley (based on Segenni 1985 map 1).

With the gradual expansion of Rome into central Italy, during the Third Samnite War, the Aterno Valley came under Roman control in 293 BC (Liv. X, 39, 1–3; Segenni 1985: 50–52). After this time a process of integration and

assimilation began. The inhabitants of *Amiternum* possibly earned the civil right *sine suffragio* as early as 290 BC (Vell. I, 14, 6–7). In 241 BC *Amiternum* was included in the newly created Tribus Quirinus. It is possible to see from inscriptions that by the Augustean period *Amiternum* had the status of a *praefectura* in the Regio IV, but was promoted to *municipium* – if at all – only in the Early Empire (Segenni 1985: 59–70). It remained as the centre of the upper Aterno Valley with several dependent *vici* (e.g. *Foruli*, *Preturo*) nearby. Though *Amiternum* is hardly mentioned in the sources of the Late Republic and the Empire, numerous building and donation inscriptions as well as honorary decrees bear witness to an especially dynamic development of the settlement. Inscriptions name official religious positions and committees, which for a Roman city of this period were quite normal. A remarkable number of inscriptions have been found giving information about the wealthy municipal upper class, which in the Late Republic already included surprisingly many members of the equestrian order and even the senatorial aristocracy. Its most well known representative is C. Sallustius Crispus who was born at *Amiternum* in 86 BC (Albino 1966). However even members of the Attii, Sallii, Vinii and other families attained high positions in the Urbs from the first century BC (Segenni 1985: 83–89; 1991: 395–401). Even though these families concentrated their attentions on Rome, they seem to have remained closely linked to *Amiternum* and contributed to the prosperity of the city through donations.

It seems that the early Roman settlement of *Amiternum* (third/second century BC) was located on the hill of S. Vittorino, perhaps continuing a presumed Sabine settlement. It was only in the Late Republican period when the site seems to have been moved to the valley, beside the *Via Caecilia*, the highway that runs through it. The oldest structure in this area is considered to be the theatre, which stands at the foot of the Colle Ribaldo, and probably dates to the Augustan period (Segenni 1985: 122–128; Coarelli and La Regina 1984: 20). Whether further settlement activity on the older higher level was taking place at this time is not known. During the course of the Empire the city in the valley level underwent great expansion. In the later first or early second century AD an amphitheatre was constructed, followed in the second and third century by aqueducts for the provision of water and to supply a bath complex. Since the nineteenth century more and more remains of grave monuments, grave inscriptions and other finds of a funerary context have come to light in the periphery of the city. The ostentatious, richly furnished tombs found in the *necropoleis* of *Amiternum* underline the image of an unusually wealthy municipal upper class.

According to epigraphic sources it seems that the active public life of the city remained largely intact until the middle of the fourth century. Inscriptions of this time bear witness to numerous renovations of aqueducts and other buildings by the *ordo splendissimus Amiterninae Civitatis* (CIL VI, 1772). It is possible that in the third century AD *Amiternum* was already provided with

its own bishop as it was, at the latest, in the fourth century AD (Pani-Ermini 1971/72: 257–274). The city was hit by a devastating earthquake in 346/347 (Coarelli and La Regina 1984: 8; Galadini and Galli 2004: 885–905). From this period until the end of the Roman Empire *Amiternum* appears in no further written sources. The city may have suffered along with the whole region during the Gothic Wars. Presumably during the course of the sixth century the reduced population and the Bishopric moved back uphill, creating a new nucleus around the Martyr Church of Saint Vitorinus and bringing to an end the settlement of the valley (Pani-Ermini 1979: 95–105).

Agriculture and transhumance

Not much is known about how the pre-Roman mountain peoples of Italy were spatially organised or how they made use of their territories. It seems that their characteristic *pagi* and *vici* and the lack of large urban centres was connected to the way in which they organised their agriculture. This allowed, on the one hand, small-scale private land ownership, but on the other hand attached great importance to the communal *ager publicus* (Gabba-Pasquinucci 1979: 21–25). From the third until the first century BC there was a profound change in agricultural production and ownership. Fundamental was the apparent sharing of the land under different private owners, with the creation of large properties and numerous *villae rusticae* in the region around *Amiternum* (Segenni 1985: 75–96). Evidently the whole agriculturally usable area of *Amiternum* was divided in some land register-like way and cut up into parts. It is most likely that with the introduction of the *villae* undertakings, the intensity of agricultural usage rose as well (CIL I, 1853). Although – due to the tough, upland climatic conditions – agricultural production could not have hoped for an above-average added net value, the same could not be said for other forms of agriculture such as stock farming and wool production. Indeed, it seems that *Amiternum* and the upper Aterno Valley had become the destination of one of the main seasonal cattle routes from Apulia as early as the second century BC (Gabba Pasquinucci: 92–182). This transhumance was conducive to optimised sheep-breeding and the accompanying meat and wool production. The majority of herds were shepherded by slaves who spent their time on the herb-rich pastures of the Abruzzi between spring and autumn, and returned to Apulia for the winter. Various inscriptions give evidence that the *Amiternum* aristocracy were heavily involved in this lucrative form of migrational stock-farming and wool production. For example, we know that the Paciani family had substantial property at *Amiternum* as well as *Luceria* in Apulia – thus at both ends of the known transhumance route (Gabba and Pasquinucci 1979: 107–108). It is most likely that income generated from this lucrative trade led to the increased prosperity of the well-to-do Amiternian upper class and enabled the acceptance of its members into the equestrian order and even into the senatorial aristocracy.

The effects of Roman transhumance on spatial organisation and land use

of the Amiternian territory have not yet been examined. Thus far it can only be presumed that the agriculturally usable areas of the valley and the lower slopes were primarily kept for cereal and wine production. The summer herding is likely to have been concentrated on the surrounding hills. This would have led to significant woodland clearance and the exposure of soils to erosion. Evidence that deep colluvium accumulations on hillsides and in dry valleys may suggest serious soil erosion linked to the intensification of Roman agriculture is discussed below. Such erosion might have significantly reduced the carrying capacity of the land and thus imposed severe restrictions on the economic productivity of the area.

Due to the crisis in the Late Roman Empire, a gradual de-urbanization process took place in Late Antiquity across the entire Aterno Valley, which under Byzantine and Langobard rule led to the abandonment of settlement areas and villas in the valley bottom (Staffa 1992: 789–853; 1995: 315–360; 2000: 47–99). During this course of events the agricultural production and property structure must have changed once more. The rural economy, which was driven by numerous private villas in the Roman period, may have been greatly reduced as a consequence of the population decline and the collapse of the market. Herding routes were no longer secure and so transhumance also succumbed, perhaps leading to a recovery of the woodland. During the course of the Middle Ages large parts of the original private property fell into the hands of the Church, and particularly the famous Benedictine Abbey of Farfa which possessed substantial property in the upper Aterno Valley (Segenni 1985: 97–102).

Methodology

The project aims to carry out a comprehensive examination of the Sabine Roman settlement of *Amiternum*, its urban structure and long-term development, as well as clarifying the relationship of the settlement to its immediate surroundings. This has been pursued using a broad multi-disciplinary project strategy which has already been successfully tested in a previous urban research project to investigate the unexcavated areas of Ostia (Bauer and Heinzelmann 1999; Heinzelmann and Martin 2000; 2002).

Satellite images and aerial photographs

Satellite images, aerial photographs, maps and plans were systematically accumulated by the project.¹ In addition, a satellite image (QuickBird) of the upper Aterno Valley was commissioned in 2006, which may now be freely consulted in Google Earth, and aerial photography flights were made annually each summer. Few of the existing or newly acquired aerial photographs are very informative about the buried archaeological remains, though they do provide a great deal of information about the geomorphological context of the site. This is probably because of a combination of effects including the depth

of some remains and the unfavourable vegetation covering the ground surface, including the cultivated crops. All the spatial information sources were accumulated and managed using a geographical information system (using Manifold GIS).

Collection of old finds

In 2009 the project began to accumulate all previously known finds and inscriptions in a database (iDAI.field), where their original location is approximately known. This is being linked to the existing project GIS. In this way such finds will be mapped and placed in context for the first time, using a variety of criteria.

Geodetic works: measurement network, digital terrain model

During the 2006 and 2007 campaigns an extensive topographic survey was carried out to map visible remains. These were documented and measured, using high-precision differential GPS, with accompanying short descriptions and photography. The records have been made accessible through a database and linked GIS.

Selective intensive survey

Within the urban area of *Amiternum*, a partial, systematic field-walking survey was carried out for architectural remains and fragments of marble decoration. The distribution of these remains was plotted using GIS and shown to correspond closely to the geophysical survey results. This study was intended to obtain additional information about the function and quality of built structures. However it also showed that piecemeal but sometimes deep excavation has been carried out since the middle ages. Moreover the site was extensively quarried for building material, in particular during the nineteenth century. Large areas of soil were spread over the site, some sourced from excavations within *Amiternum* itself, some from further afield. This soil spreading was presumably intended to increase soil quality. This occurred in some areas where fieldwalking recovered concentrations of marble fragments and ancient building materials, where geophysical prospection showed no corresponding buildings. The apparent concentration of surface finds would thus – taken alone – result in a considerable distortion of our understanding of the city, or even a complete misinterpretation of our wider survey results. This kind of earth movement and disturbance is characteristic of many sites in Italy. Systematic surface survey within ancient towns in densely populated areas like Italy must therefore be tested using other methods.

Geoarchaeology

The Roman city of *Amiternum* was built on the banks of the river Aterno,

where it emerges from a constricted upland valley onto a broader plain sloping gently down towards L'Aquila. Much of the city was constructed on pre-Roman river terraces, where the buried building remains lie close to the modern ground surface. Where the city extends up the slopes of the steep limestone hills which enclose the valley the remains have been partly buried in colluvium deepened, in places, by displaced soil apparently including the spoil of earlier excavations. The Aterno Valley, its tributaries and the lower slopes around them have deep alluvial and colluvial fills. These have been tentatively dated to the pre-Roman Holocene on stratigraphic grounds and on the basis of preliminary OSL dates. Thus the alluvial and colluvial deposits of the valley around *Amiternum* may contain very interesting sequences of deposits which record the complex interplay between Roman and pre-Roman economy, landuse and erosion. For example deep sections of colluvium examined during this projects on the valley sides, as well as deep dry valley colluvial fills nearby, suggest that many of the soils of the steeper hillsides, otherwise suitable for grazing, may have already been seriously thinned by erosion and structurally weakened by the Late Republican period. This suggests that the clearance of the hillsides has started already in the pre-Roman period. Thus it is conceivable that the economic success of Roman transhumance led to pressure to increase the number of animals grazing on these vulnerable soils around *Amiternum* to a point where the ground vegetation cover was depleted, plant productivity decreased, erosion increased and the land could no longer support such a large number of animals. This might have seriously impacted on the transhumance economy, at least for a while, perhaps forcing a reduction in land use and a shift in grazing patterns during Late Antiquity. It may also have made the hillsides very vulnerable to erosion and evidence for a related pulse of sediment deposition might be a target for future research.

Geophysics

The Roman remains consist largely of limestone walls buried in soils derived from colluvium and alluvium, mixed with substantial amounts of ceramic debris. A strong contrast in magnetic susceptibility between the soil and walls has been demonstrated, both because of the naturally high susceptibility of the colluvium and because of the ceramic admixture. There is also a strong contrast in electrical resistivity, because the soil is naturally moist and clayey and the walls are often substantial, well-constructed and preserved to a considerable height. This makes the site an excellent candidate for magnetic imaging. An extensive magnetometer survey of c. 30ha, covering more or less the whole settlement in the valley, using a 4-sensor Geometrics G-858 Caesium-Gradiometer on a measuring cart, has produced very useful results, although the clarity of the images varies with the nature of the soil and the components that have been mixed into it at different parts of the site (Figure 3.3). Smaller areas of electrical resistivity survey, conducted with a Geoscan

RM 15 ER meter with a 0.5m separation twin-electrode array, show the buried walls less clearly because of their depth, but electrical resistivity tomography has been very successful in clarifying the location and depth of the walls, as well as their contexts within the natural deposits on the site. Ground-penetrating radar (GPR), using a GSSI SIR-20 with both 250 and 400 MHz antennas, has been unsuccessful in all but a few parts of the site, probably because of the depth of the remains, the relatively high electrical conductivity and the abundance of archaeological debris. GPR survey has only proved effective at *Amiternum* where the remains lie very close to the surface, perhaps revealing the remains as patterns of variation in ground electromagnetic coupling rather than as patterns of radio wave reflection (Figure 3.4).

The magnetometer survey results are similar to those obtained at other classical sites in the Mediterranean region, such as Ampurias (Aquilué *et al.* 2000: 261–279), where limestone walls appear as negative magnetic anomalies against a background of more magnetically susceptible archaeological deposits. It is notable, however, that the strong susceptibility contrast, the size, and the compact structure of the walls make it possible to detect buried buildings at *Amiternum*, such as the large *domus* discussed below, at unusual depths of up to 1.5m. This has aided the selection of sites for excavation in places where it would not otherwise have been possible.

In a separate survey exercise approximately 400 individual measurements of magnetic susceptibility were made at intervals of *c.* 50m across the whole of the ancient town and adjacent areas, using a Bartington MS2 instrument and a field coil. Magnetic susceptibility survey sometimes detects ancient habitation because human activity (fire, the disposal of organic waste and the distribution of ceramic fractions) usually increases the ability of the soil to become magnetised. The interpretation of the results at *Amiternum* is complicated by the high susceptibility of some natural colluvial soils on the hillsides around the site.



Figure 3.3 Amiternum. Results of the magnetometer survey superimposed over a corrected Quickbird satellite picture. 1. Theatre, 2. Theatre street, 3. Domus, 4. Domus, 5. Aqueduct, 6. Via Caecilia, 7. Forum, 8. Basilica, 9. Commercial building, 10. Street with shops, 11. River embankment wall, 12. Sanctuary, 13. Sanctuary, 14. Sanctuary (?), 15. Sanctuary (?), 16. Amphitheatre, 17. Domus, 18. City wall of hill top settlement (?).

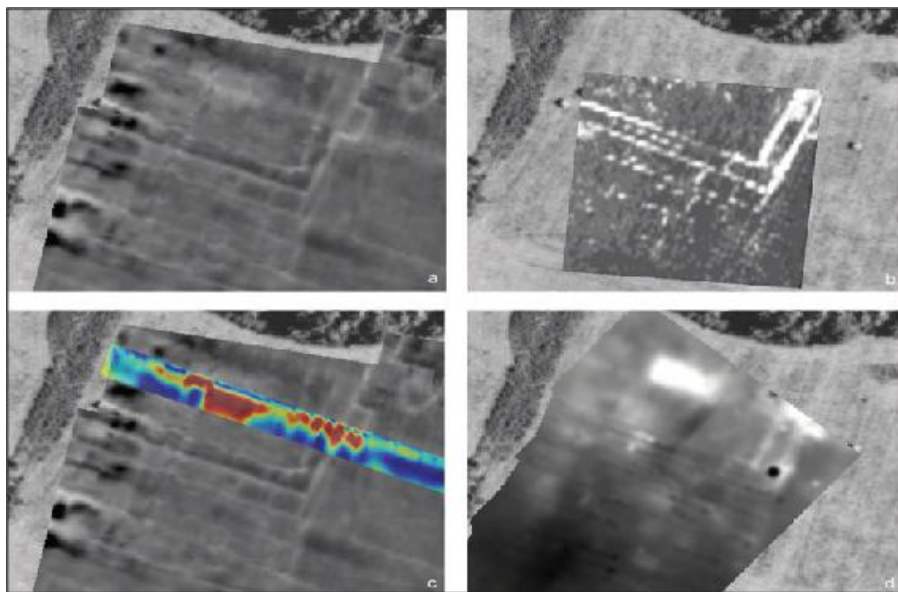


Figure 3.4 Geophysical survey results over the monumental centre of the Roman city. a. Caesium magnetometry (light tones represent lower, dark tone higher magnetic field strength), b. Electrical resistance (light tones represent higher, dark tone lower resistance), c. Magnetometry with vertical electrical resistance profile superimposed. The ERT profile was recorded along the ground surface and represents apparent resistivity to a depth of approximately 1.5m, d. Ground penetrating radar.

The geophysical properties of the site have been examined, in key locations, by carrying out geophysical measurements at unusually high density and with a high proportion of replicates. These have then been followed by precise excavation of the same areas during which measurements of soil properties have been recorded, including those properties (dielectric, electric and magnetic) which most influence surface geophysical survey results. Thin sections and bulk samples have also been taken and analysed in order to identify the origins of the geophysical properties of the archaeological deposits in the origins of the deposits themselves.

This exercise has greatly increased our understanding of the geophysical properties of the site and has enabled us to reach firmer interpretations of the geophysical datasets. Taken together the geophysical surveys and analyses have shown the benefits of a flexible, comprehensive 3-dimensional survey approach. They have also made clear the value of combining inherently depth-related geophysical imaging (ground radar and electrical tomography especially) with geoarchaeological analyses which clarify their interpretation. Indeed, since key dielectric and electrical properties proved to have unexpected distributions, the lack of such local insights into the geophysical survey produced by analytical excavation, might have led to misleading interpretations.

Stratigraphic excavation

During the campaigns from 2007 to 2010 13 stratigraphic excavations were carried out in different areas of the city. These aimed to assess and clarify the geophysical survey results and provide a chronology for the phases of building construction and use. These superimposed constructions were selected for excavation to provide an insight into the development of the settlement. The excavations examined:

- a large *Domus* (Figures 3.5–3.7), 100m south of the theatre, dating to the early Imperial period, overlying previous constructions, and the road onto which it fronted (trench 1–3)
- the newly discovered, probably Augustan, Forum Basilica with a apsidal annexe (trench 4, 5)
- the west side of the Forum with its Portico (trench 10)
- a street leading southeast from the Forum and associated imperial architecture (trench 13)
- a building of unknown function close to the amphitheatre (trench 6/7)
- an imperial-period podium Temple and fronting constructions, including a Portico, on the east side of the *Via Caecilia* (trench 8, 11)
- an apsidal bathing pool probably belonging to a bath complex (trench 9)
- a section of the *Via Caecilia* with accompanying buildings to the south of the urban centre (trench 12)

Results

The original settlement, the earliest phases of which are so far undocumented, was situated on the eastern hill of S. Vittorino. In the late second or early first century BC, the focus of the settlement activity shifted to the *Via Caecilia* at the foot of the hill. The development spread at first from within the area between the theatre and the Aterno River, the flooding and erosion of which required elaborate flood defence and bank control structures. In the Augustan period the valley settlement was the scene of extensive renovation, during which many older buildings (beneath the theatre and the *domus*) were abandoned and levelled. Alongside the new and unusually large residential buildings, the settlement experienced a remarkable monumentalization with the construction of the theatre, the forum and the basilica. A large central street, which ran parallel to the *Via Caecilia*, connected the theatre with the forum. In contrast, on the south-eastern side of the forum the shop-lined street changes direction to conform to the terrain, adopting the orientation of the river. Thus, in these peripheral areas no underlying town plan can be identified. The total area of the settlement in the valley, and the number of dwellings, is small when compared with the abundance of public buildings.

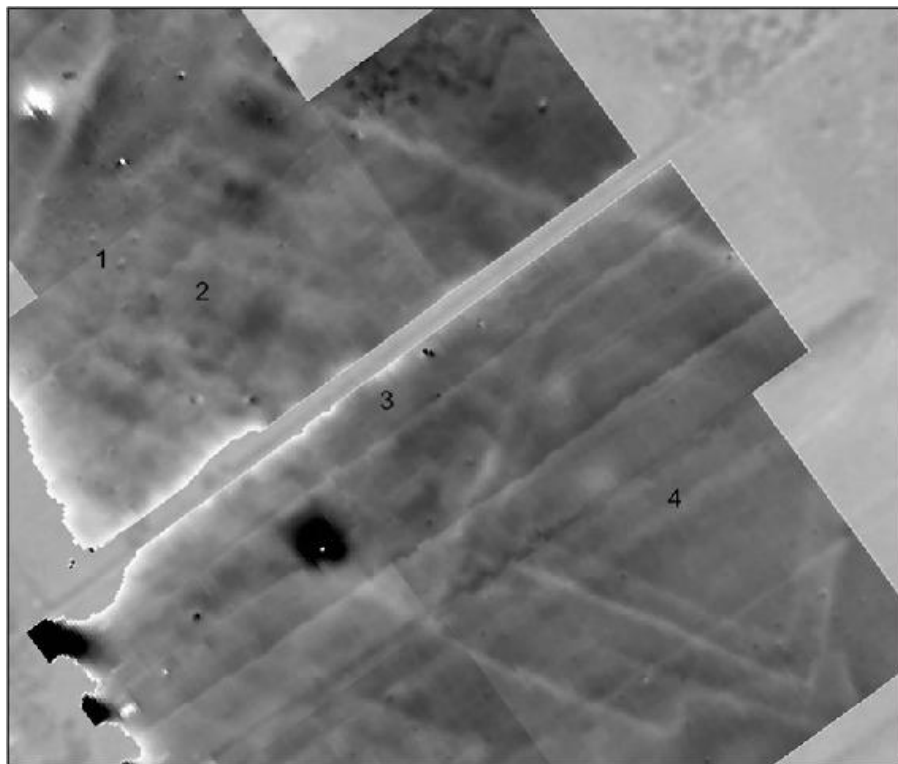


Figure 3.5 Domus south of the theatre (see fig. 3 nr. 4). Detail of the results of the magnetometer survey.

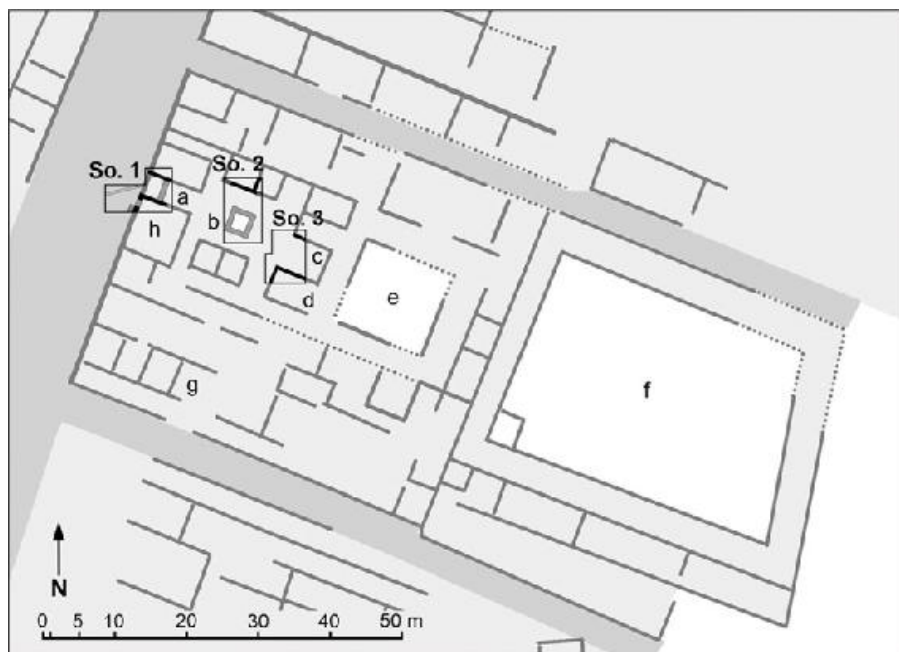


Figure 3.6 Domus south of the theatre. Interpretation of the magnetometry results and



Figure 3.7 Domus, trench 2. Atrium with impluvium.

In a later phase of development, which may date to the late first and second century AD, the settlement along the *Via Caecilia* extended southwards from the other side of the Aterno. Here, along a length of 300m on either side of the road, grew a dense development. Strikingly, however, here also the building development was narrow and no streets parallel to the *Via Caecilia* were created. The emerging character of this urban area appears unbalanced: at least two major sanctuary complexes are certain consisting of portico-surrounded spaces with a central temple podium, and two more are also suspected. These sanctuaries are located on both sides of the *Via Caecilia* and their facades are orientated with the street. Towards the end of the first or in the early second century AD the amphitheatre was constructed, set back from this central axis. Between these public buildings are buildings with commercial functions, and isolated, some large *domus*. The latter, however, remain clearly in the minority, and there therefore arises a strangely

contradictory picture of a strong urban infrastructure, with a disproportionately large number of public buildings, and a correspondingly small number of residential buildings.

During the second century the residential buildings experienced a further prestigious decorative phase, while no extensive evidence of such attention to public buildings can be thus far proven for the high Empire. The buildings of the valley settlement were still in use until at least the first half of the fourth century. The large *domus*, at least, was totally destroyed perhaps by the earthquake of AD 346 for which we have historical records. Some degree of subsequent, crude resettlement can be observed, but it can be assumed that *Amiternum* was gradually being relocated back to the hill of San Vittorino, where the medieval town grew in the area around the Church of the Martyrs.

Conclusions

Evaluating the effectiveness of the methods employed

Despite the systematic collection of aerial photographs and regular re-flying aerial archaeology has, to date, delivered no significant evidence of the ancient structure of the town. In contrast, geophysical prospection at *Amiternum* has proved very effective, although there is a considerable contrast between the effectiveness of the various methods used. Magnetometry and electrical resistivity survey have produced detailed images which are exceptionally rich in information about the buildings and spatial structure of the town. The effectiveness of electrical resistivity, however, has proved very dependent on the soil moisture state, as we would expect. Georadar, by contrast, has produced relatively few useful results. Fieldwalking results have also proved of limited value, or are even misleading because of the extent and depth of previous soil disturbance across the site. Thanks to the excellent geophysical survey results it has been possible to target stratigraphic excavation very precisely to address specific questions of chronology and function. Combining comprehensive non-invasive exploration methods with targeted minimally invasive excavation and soil analysis has proven to be a particularly efficient project strategy to study urban issues in *Amiternum*.

Historical interpretation

The results of the project change the current picture of Roman *Amiternum* considerably. It is possible that *Amiternum* was not a well-developed country town of medium size, as was previously assumed, but was rather a partially developed urban centre providing administrative functions and other services for a larger catchment area. Perhaps this is also a reason why *Amiternum* remained only a *praefectura*, at least until the Augustan period, and why it was upgraded to a *municipium* at a comparatively late date, if at all. At the same time, some large, richly furnished houses indicate the presence and

significant influence of a wealthy upper class, which probably also explains the remarkable public and religious buildings of the city. From the first century BC a significant number of representatives of this *Amiternum* elite rose to become members of the equestrian order and even senators. Epigraphic evidence shows that this elite not only had extensive land-holdings in the *Amiternum* area, but they also engaged extensively in the very lucrative transhumance agriculture of the zone. It appears that *Amiternum* and the upper Aterno valley were a major destination for the transhumance routes from Puglia. The intensive grazing of the surrounding mountain areas by summer livestock may, in turn, be a crucial factor in the extensive deforestation of the Abruzzo region in Roman times. Given the surprising character of the biased urban development at *Amiternum*, future studies must address the issue of peripheral settlement around the city. Rescue excavations and other evidence for *vici* and villas, already suggest that *Amiternum* might have formed the centre for a dense population in the upper Aterno valley. It may be possible that specific Sabine traditions may be identifiable in this settlement pattern.

Note

- 1 Collections including those of the Istituto Geografico Militare in Florence, the Fototeca and Aerofototeca Nazionale of the Istituto Centrale per il Catalogo e la Documentazione (including WWII aerial photographs taken by the German Luftwaffe and the Royal Air Force), the Soprintendenza per i Beni Archeologici in Chieti and the regional cartographic service of the Regione Abruzzo in L'Aquila.

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Paestum romana. Problemi di interpretazione e strategie di intervento

M. Cipriani e A. Santoriello¹

Introduzione

Il progetto, avviato nel 2003 e tutt'oggi attivo, consiste in un articolato programma di studi e indagini sulla città e il territorio di *Poseidonia-Paestum* e nasce dalla fattiva collaborazione, regolata da una convenzione, tra la Soprintendenza per i Beni Archeologici delle Province di Salerno, Avellino, Benevento e Caserta e il Dipartimento di Scienze del Patrimonio Culturale dell'Università di Salerno. Le ricerche, in corso e future, già attuate o programmate, si avvalgono di Fondi Strutturali Europei (FSE) e di risorse umane, economiche, logistiche e strumentali messe a disposizione da entrambe le istituzioni².

È quasi superfluo sottolineare che la deduzione della colonia latina di *Paestum*, avvenuta nel 273 a.C., poco prima della conclusione della guerra tra Roma e Pirro, ebbe un impatto politico e sociale ben percepibile nelle trasformazioni che investirono un'area urbana ed un ambito territoriale strutturati sin da età arcaica e modellati da tre secoli di storia. Ciò è stato ben dimostrato dalle ricerche³, quindi ci soffermeremo solo brevemente sui cambiamenti intervenuti durante la lunga vita di *Paestum* romana cercando di focalizzare l'attenzione su alcune prospettive aperte da scavi e studi recenti, su alcune delle tante questioni ancora degne di approfondimento, con particolare riguardo alle strategie di ricerca sull'analisi del paesaggio.

Va in ogni caso premesso che i dati che presenteremo, alcuni dei quali ampiamente noti, sono il frutto, nel caso dell'area entro le mura, di indagini effettuate pressoché esclusivamente nella zona centrale della città, che mantenne sempre una funzione pubblica, e solo su parte dei quartieri abitativi. Ciò impone prudenza e l'obbligo di non generalizzare i risultati, soprattutto quando questi pongono ulteriori problemi di interpretazione.

Lo stato attuale delle conoscenze nel centro urbano e nel territorio

L'età repubblicana

Indagini recenti condotte nel tratto orientale delle mura di cinta, tra porta Sirena e la torre 28⁴, sembrano far definitivamente tramontare l'ipotesi, già del Krischen⁵ e poi di Theodorescu⁶, che circa un terzo della città, all'incirca corrispondente alla parte situata ad est della strada borbonica, fosse un ampliamento seguito alla deduzione coloniale del 273 a.C. Si è infatti messo in luce, al piede della cortina interna di questo tratto di cinta un asse stradale liminare, orientato nord-sud e databile alla fine del VI sec. a.C. Il suo tracciato, fiancheggiato da più antiche o coeve strutture di funzione sacrale, è parallelo a quello poi seguito dalle mura ed in parte inciso dalle fondazioni del paramento interno della cinta. Il prolungamento di questa strada incrocia la grande *plateia* tardo arcaica est-ovest, il cui tracciato, più volte rialzato, funziona fino ad età imperiale avanzata per collegare l'area urbana con il territorio collinare ad est. Ciò porta a ritenere che ad oriente l'estensione dello spazio urbano, definita sin dall'*apoikia* sibarita, sia la stessa successivamente delimitata dal circuito delle mura⁷ (Figura 4.1).

I risultati delle indagini di scavo coniugate all'analisi del rilievo architettonico hanno inoltre permesso di puntualizzare che il tratto orientale del circuito murario a nord e a sud di Porta Sirena, nonché l'impianto della porta che precedette quella oggi conservata in elevato, sono il frutto di un progetto unitario, realizzato dai coloni latini intorno alla metà del III sec. a.C., consistito nel rifacimento di strutture difensive preesistenti⁸.

Il tracciato delle mura in questa zona infatti si è impostato e ha ampiamente riutilizzato e rimaneggiato elementi di strutture pertinenti ad un circuito e ad una porta costruiti dai Lucani nei decenni finali del IV sec. Il rifacimento della porta e del tratto di cinta ad essa collegato comportano la distruzione di un sacello esistente sin dagli anni centrali del V sec., rinvenuto sul versante interno della cortina, a 13 m a nord dal fornice di porta Sirena.

In città i Romani recepirono la sostanza dell'impianto regolare greco risalente ad epoca arcaica e risparmiarono, riadoperandole e aggiungendovi edifici propri, le due principali aree sacre a nord e a sud dello spazio pubblico. Dagli studi di E. Greco e D. Theodorescu⁹ sappiamo che modifiche sostanziali furono apportate, invece, alla parte centrale, quella a destinazione pubblica e già sede della immensa *agora* (c. 10 ettari). Di questo enorme spazio i Romani scelsero per impiantare il Foro solo una porzione del settore meridionale, quella apparentemente meno ricca di preesistenze e certamente meno carica di quelle valenze politiche caratterizzanti in età greca e lucana la parte nord della piazza. Come ha giustamente sottolineato E. Greco¹⁰, l'area scelta per la piazza forense era la sola che gravitava direttamente su un punto nodale nella topografia urbana, l'incrocio tra le due *plateiai* est-ovest e nord-sud. Il Foro fu collocato proprio a cavallo della *plateia* est-ovest, che venne spezzata in due cosicché il Foro era raggiungibile sia da est che da ovest attraverso i due tronconi perpendicolari ai suoi lati corti, mentre la grande strada nord-sud lo bordava sul lato occidentale. Una volta disegnato il rettangolo della piazza, i cui lati vennero bordati da *tabernae*, furono eretti i

monumenti che dovevano permettere il funzionamento delle attività politiche e giudiziarie¹¹, mentre nello spazio a nord del Foro fu edificata una grande *natatio* racchiusa entro un muro di recinzione, complesso destinato al culto di *Fortuna Virilis-Venus Verticordia*¹². Per assicurare la percorribilità della *plateia* A (nord-sud), in parte invasa da *tabernae*, essa fu ridotta ad un *ambitus* il cui tracciato correva dietro le botteghe del lato occidentale.

Dopo la destrutturazione e obliterazione degli edifici più carichi di valore politico (*heroon* ed *ekklesiasterion*, quest'ultimo obliterato da un santuario con fronte porticata) e di altre strutture funzionanti tra V e IV sec. a.C. condotte nel corso del III a.C.¹³, la parte settentrionale di quella che era stata l'*agora* fu, se non del tutto abbandonata, di certo resa marginale, per tutto il periodo medio e tardo repubblicano¹⁴.

Di converso, dai coloni latini venne mantenuta in vita – e lo sarà sino alla fine della repubblica – un'area sacra, forse connessa ad un culto di tipo ctonio, sita ad oriente dell'antica *agora* e attiva dal V sec. a.C.¹⁵.

Gli isolati di abitazione, messi in luce fra gli anni Trenta e Settanta del secolo scorso solo nella parte occidentale della città, attraverso caotici e non documentati scavi, non permettono di proporre un esaustivo quadro d'insieme della situazione delle case repubblicane, peraltro interessate da notevoli mutamenti planimetrici nel corso dell'età imperiale. Tuttavia l'ottima edizione delle degli scavi case dell'isolato a nord del decumano¹⁶ e i risultati di sondaggi stratigrafici recentissimi, condotti all'interno di alcuni ambienti degli isolati a sud del decumano, offrono testimonianze preziose circa le modalità della romanizzazione di *Paestum* e impongono riflessioni sulla nozione stessa di 'casa romana'.

Alcune delle abitazioni individuate nell'isolato nord, il cui impianto è datato tra la fine del III e la prima metà del II sec. a.C. al più tardi, conservano complessivamente, nonostante le trasformazioni successive, la planimetria delle abitazioni a peristilio di tipo ellenistico¹⁷. Nulla, allo stato attuale delle conoscenze, permette di affermare che l'adozione di tale schema planimetrico, soppiantato quasi ovunque in Italia dalle case di tipo italico 'ad atrio', si giustifichi per il condizionamento imposto da strutture abitative appartenenti alla fase preromana¹⁸. È preferibile ipotizzare che nel caso di *Paestum*, colonia dedotta in un territorio già ampiamente strutturato in forma urbana, l'articolazione delle aree domestiche non obbedisca a schemi rigidi, né ad un unico modello funzionale, ma adotti soluzioni di compromesso con modelli dell'architettura domestica locale preesistente¹⁹. Di questa purtroppo non si conosce nulla o quasi, né in questa parte della città si sono rinvenuti, nonostante i saggi di approfondimento sotto le case romane, resti sicuramente attribuibili a strutture di abitato precedenti la deduzione coloniale latina.

L'unico caso finora noto di un'abitazione di età repubblicana (II sec. a.C.) che occupa un'area certamente destinata a funzioni abitative in epoca greca ma già abbandonata intorno agli anni 480–470 a.C., è attestato in un isolato a nord-ovest del tempio di Atena²⁰.

La tarda età repubblicana

Al periodo di stagnazione che, stando ai documenti archeologici, fa seguito alla seconda punica, segue una fioritura in età tardo repubblicana. Molti sono i segni di ripresa in area pubblica: dalla metà del I sec. a.C. si ritorna a costruire a nord della *piscina publica*, in quello che era stato il settore mediano dell'*agora*, del tutto marginalizzato all'indomani della deduzione coloniale latina. Viene edificata una *porticus* con botteghe²¹ e presso il margine orientale di queste il primo anfiteatro. I *duoviri*, P. Claudius e C. Sextilius dotano la città di una rete idrica²².

L'età imperiale

L'emergere sulla scena politica locale di famiglie importanti che avevano fatto parte del partito cesariano si lega ad episodi di evergetismo femminile: Mineia, moglie di C. Cocceius Flaccus, agli inizi del I sec. fa edificare la Basilica Forense²³. Negli stessi anni viene ristrutturato il Foro: si abbassa di 1m il livello della piazza che viene circondata da portici con colonne e capitelli di spoglio. Ma è soprattutto quanto si ricava dall'edilizia privata che dà conto di mutamenti, anche traumatici e cesure nei regimi di proprietà delle case, di dismissione di spazi abitativi cui si contrappone la creazione di nuove aree residenziali.



Figura 4.1 Paestum. Pianta della città con lo sviluppo degli isolati e lo spazio pubblico centrale.

Nella prima età imperiale si registrano consistenti interventi nelle case

gravitanti sul *compitum* con defunzionalizzazione di parti e nuove destinazioni di spazi (parti di un edificio termale obliterano l'atrio repubblicano di una casa di un isolato a sud del decumano). Al contempo sono verificabili, attraverso l'abbandono di alcune delle aree di abitato di età repubblicana e, di converso, la creazione *ex-novo* di quartieri che occupano aree già marginali, fenomeni di marcata discontinuità con il passato repubblicano che forse riflettono complesse dinamiche di tipo socio-economico. Nello spazio residenziale di tipo urbano più lontano dalla zona pubblica del Foro e dei santuari, vale a dire nelle case a nord-ovest del tempio di Cerere, sono documentati, dopo la fioritura in età repubblicana, segnali di crisi apertamente manifesti già nel I secolo dell'impero. Infatti, la già ricordata casa repubblicana sorta nel II sec. a.C. alcune decine di metri ad ovest del santuario settentrionale, risulta abbandonata nei primi decenni del I sec., quando vi fu nascosto in una parte dismessa dell'atrio un tesoretto di 28 monete in bronzo, sepolto in età tiberiana²⁴. La vita di questa *domus* coincide in larga parte con l'arco di tempo entro cui si datano le monete di un ben più cospicuo tesoro, nascosto dopo la presa del potere da parte di Augusto, in un'altra *domus* vicina forse abbandonata nello stesso periodo²⁵. Si assiste quindi ad una contrazione nell'uso di questo spazio residenziale più periferico che, poco più tardi, appare occupato da un impianto di tipo rustico²⁶. Al contrario, si riempie contestualmente di case quello spazio marginalizzato e semiabbandonato coincidente con il settore nord-occidentale dell'*agora*: qui viene creato *ex-novo* un asse stradale (An1), elemento aggregante per una serie di nuovi isolati che continueranno ad esistere fino ad epoca tardo imperiale²⁷. Forse esiste una relazione causale tra l'abbandono degli impianti abitativi nella parte occidentale della città e la parziale densificazione delle case lungo il nuovo asse stradale²⁸.

Altre dinamiche di discontinuità si colgono nell'area ad oriente dell'antica *agora*. Questa zona, che anche dopo la deduzione coloniale latina e fino alla fine dell'età repubblicana aveva mantenuto la sua connotazione sacrale, definita sin da età greca, cambia nettamente funzioni: completamente obliterata diviene intorno alla metà del I secolo sede di un impianto rurale²⁹.

In età tiberiana si collocano alcuni interventi edilizi nel Foro e, nel corso della prima metà del I secolo, l'interro della *piscina publica*, mentre l'asse di gravitazione si sposta a nord verso la valletta dell'anfiteatro.

Dalla colonia flavia al tardo impero

La deduzione della colonia flavia avvenuta nel 71 d.C. ebbe, almeno in una prima fase, un effetto dinamico sulla vita della città: nuove famiglie emergenti e personaggi come T. F. Marullus, lasciano la loro impronta tanto negli spazi pubblici quanto nell'edilizia privata, dove, in particolare, sono verificabili importanti rifacimenti che denunciano nuovi avvicendamenti nel regime proprietario o il consolidarsi della posizione sociale dei proprietari stessi³⁰; negli spazi abitativi di maggior pregio, quelli più prossimi al Foro, sono ora

evidenti episodi di trasformazione delle funzioni di ambienti domestici sottratti all'uso privato.

Tra il II sec. e la prima metà del successivo si registra una limitata ripresa dell'attività edilizia nell'area forense legata all'emergere di nuove aristocrazie. Ai primi decenni del III sec. si datano il rifacimento della Basilica forense, la costruzione del *Macellum* e la ricostruzione, dopo un incendio, delle terme a sud del Foro da parte di un esponente della famiglia dei Cicerones³¹. Interventi di evergetismo, attestati da iscrizioni onorarie, si devono alle famiglie dei Pomponii, legati alla marina militare e dei Vinicii, di rango equestre, ricordati anche da un'iscrizione recentemente scoperta in uno degli isolati abitativi a nord del decumano³².

Se l'insieme dell'evidenza archeologica nota denuncia segni di crisi nella vita della città, soprattutto al confronto con la fioritura di età tardo repubblicana e giulio-claudia, un dato interessante e degno di ulteriori approfondimenti è quello che modifica il quadro tradizionalmente delineato per *Paestum* in età tardo antica. Il centro, seppure estremamente impoverito, mostra ancora qualche segno di vitalità nelle opere di restauro della Basilica forense³³ e dell'acquedotto³⁴. Mentre nel IV secolo edifici pubblici come la *porticus* a nord del Foro cadono in abbandono, a sud del *compitum* nuove case private invadono anche le strade, annullando in parte la viabilità preesistente. Forni da calce impiantati in quest'epoca in alcune delle case più prossime al centro urbano, più che segnali di abbandono sembrano funzionali ai cantieri per la costruzione o la riqualificazione delle *domus*. Alcune di esse risultano non più destinate all'uso abitativo, altre continuano ad essere occupate, con modifiche parziali nella pianta per adattare a nuove esigenze. Nel corso del V sec. un ambiente di rappresentanza di una casa, sita alcune decine di metri a sud-ovest dell'antico *Athenaion*, viene pavimentato con un mosaico policromo a decorazione geometrica. Le notevoli quantità di vasellame di uso domestico ne attestano inoltre la vitalità e la funzione abitativa almeno fino al VI sec. Se tali dati registrati in parti limitate dello spazio racchiuso entro le mura hanno indotto, sia pure con cautela, ad ipotizzare uno spostamento del polo di attrazione cittadino dalla zona forense, centro della città romana, all'area settentrionale, fulcro della *Paestum cristiana*³⁵, essi non vanno generalizzati ed estesi anche ad altri settori dell'abitato di cui poco o nulla sappiamo. La grande frattura con il passato sembra risiedere nella diversa connotazione conferita all'area entro le mura: labili, ma significativi indizi fanno pensare ad un tessuto abitativo a macchie che annulla in parte la viabilità tradizionale, mentre la piazza forense e quella che era stata l'antica *agora* divengono luogo di sepoltura.

Le necropoli

La trasformazione politico-sociale dovuta all'arrivo dei coloni latini e le nuove regole sociali e religiose della colonia, fanno registrare nelle necropoli

una brusca rottura con il passato, anche se in questa fase iniziale si utilizzano gli stessi spazi funerari della città greca e lucana.

Esemplare è il caso della necropoli di S. Venera³⁶ dove i nuovi venuti impostano su tombe a cassa di epoca lucana sette recinti funerari di forma quadrangolare disposti su due file parallele divise da una fascia centrale che doveva fungere da asse stradale. All'interno di essi i resti incinerati dei defunti erano deposti in urne fittili, databili entro la seconda metà del III sec. a.C. All'alzato degli edifici appartenevano rocchi di colonne rinvenuti nelle immediate vicinanze. Tale circostanza li connoterebbe come *naiskoi* funerari, in qualche modo assimilabili ai già noti "tempietti" attestati a Paestum nelle necropoli del Gaudio e della Licinella³⁷, esempi di tombe monumentali su basso podio con ante e modanature di tradizione medioitalica, in seguito adattati in modo da accogliere anche piccoli nuclei familiari. Tali edifici, di datazione discussa, proposta esclusivamente in base al profilo delle cornici del podio, vengono attribuiti da P. C. Sestieri al III sec. a.C. o datati nel corso del II sec. a.C.³⁸, anche per analogia con quanto avviene nel resto d'Italia, dove in quest'epoca i ceti emergenti tendono a dotarsi di sepolcri individuali di tipo eroico. A parte ciò la documentazione relativa alle necropoli della colonia sino alla tarda età repubblicana è estremamente scarsa.

A partire dalla fine del I sec. modeste tombe alla 'cappuccina' di tegoloni si addensano intorno ai *naiskoi* funerari repubblicani³⁹; si intensifica lo sfruttamento come necropoli dello spazio ai piedi della cortina esterna delle mura⁴⁰, ma, al contempo si seppellisce anche nelle aree a nord della città, tradizionalmente adibite a questo uso⁴¹.

Il territorio

Le ricerche effettuate sino agli anni Novanta si sono concentrate, per quanto concerne la fase romana, essenzialmente su lavori da immagini telerilevate orientati allo studio dell'evoluzione della linea di costa, delle strutture portuali e sul riconoscimento di una divisione regolare della campagna a nord del sito urbano fino al Sele⁴² e ad est fino alle pendici delle colline di Capaccio⁴³ (Figura 4.2).

La catastazione, con un'estensione pari a c. 3000ha, è stata messa in rapporto con la centuriazione seguita alla deduzione coloniale latina. La divisione dello spazio agrario è realizzata mediante decumani di notevole lunghezza, associati a *rigores* di minore importanza. Sembrerebbe che, all'indomani della deduzione della colonia flavia, come chiariscono alcuni saggi effettuati nel territorio a nord della città, i canali che si erano sviluppati lungo gli assi della centuriazione appaiono definitivamente interrati dai lapilli dell'eruzione del 79, trovati in giacitura primaria e mai più rimossi⁴⁴. Tale dato, interpretato come segnale di una crisi in atto all'interno della colonia, potrebbe, a nostro avviso, indiziare invece un diverso uso del territorio agricolo e non essere l'immediato sintomo di un suo abbandono. Questo tema

di ricerca, che necessita di ulteriori approfondimenti, rappresenta uno dei punti del programma in corso, teso anche all'effettuazione di indagini sulle opere infrastrutturali di comunicazione e approvvigionamento (la viabilità, gli approdi, il sistema idrico, ecc.).

Metodi e strategie di intervento

A partire dalla complessità e, in taluni casi, dalla parzialità dei dati a disposizione, uno degli obiettivi principali su cui si fonda l'intero progetto è intimamente legato alla riflessione su approcci e strategie da intraprendere affinché sia realmente possibile recuperare le informazioni delle ricerche passate, in maniera tale da renderle nuovamente 'attive' nei processi conoscitivi che, oggi, possono avvalersi di nuove serie documentali a supporto della lettura e interpretazione dei dati.

Lo scopo concreto è quello di passare, filtrandoli con strumenti concettuali e tecnici più aggiornati, da un livello sostanzialmente 'orizzontale' (distribuzione non diacronica o per archi cronologici molto ampi, tipologie insediative generiche, rappresentazione bidimensionale delle evidenze e del paesaggio, ecc.) a un livello 'verticale' che preveda una segmentazione delle informazioni più dettagliata per quantità e qualità, che offra un quadro diacronico, 'dinamico' e globale delle trasformazioni dei paesaggi e delle forme di occupazione del territorio. Prendendo in esame anche periodi meno conosciuti (ad es. dall'età medio imperiale all'alto medioevo) poiché in parte *oscurati* dalle ben più note e documentate vicende legate alle fasi più antiche.

Il programma prevede, da un lato, il recupero e la risistemazione, a partire dalle fonti bibliografiche e dalle notizie di archivio, dei risultati prodotti dalle ricerche passate, dall'altro a prospezioni dirette e indirette (analisi ambientali e ricognizioni sistematiche intensive di superficie, telerilevamento, cartografia storica), anche a carattere tematico.

In virtù di questi presupposti, in prima battuta, l'organizzazione della ricerca è stata impostata sulla messa a punto di una base, su piattaforma GIS, che acquisisse e gestisse la documentazione esistente integrata da molteplici supporti, raster e vettoriali. L'intento è quello di far interagire in una base spaziale univoca le conoscenze già note e di interrelarle con i risultati di indagini, in corso, archeologiche e geoambientali, attraverso un rinnovato sistema di relazione⁴⁵.

Al contestuale lavoro di recupero, archiviazione e processamento di tali *set* diversificati di dati, è stato avviato uno studio fondato su immagini telerilevate che comprende la lettura e la verifica di precedenti lavori di fotointerpretazione finalizzati alla ricostruzione del paesaggio agrario⁴⁶.

L'esigenza di ampliare le fonti di conoscenza ci ha condotto a una sperimentazione a tutto campo⁴⁷, prevedendo, proprio per le caratteristiche di centro pluristratificato di *Paestum*, l'uso e lo sviluppo di analisi di intelligenza artificiale per testare scenari non immediatamente percepibili all'occhio

umano. In particolare sono state effettuate elaborazioni di scene satellitari (Landsat TM7, Spot 5, Aster, Ikonos II) operate sulle diverse combinazioni delle bande spettrali che hanno garantito, sovente, l'esaltazione di fenomeni geomorfologici e idrologici, dal Quaternario all'eruzione del 79 d.C., e l'individuazione di infrastrutture antiche riscontrate anche nelle foto storiche ma in prima battuta di incerta interpretazione.

Accanto a questo tipo di analisi ne sono state eseguite altre su alcuni contesti significativi. In particolare, è stato applicato un filtro, normalmente utilizzato nel campo delle reti neurali, per il riconoscimento automatico di allineamenti isorientati e di concentrazioni anomale di 'oggetti' nella trama attuale del paesaggio. L'operazione, combinata con analisi spaziali, ha dato buone risposte in merito alla distribuzione delle aree sepolcrali disposte nella fascia periurbana della città, fornendo nuovi spunti di riflessione sulla topografia e sulle aggregazioni di senso circa le articolazioni interne ed esterne degli spazi funerari⁴⁸.

L'insieme di strategie e metodi di ricerca orientato alla ricostruzione dei paesaggi antichi di *Poseidonia-Paestum* è completato da un articolato programma di ricognizioni sistematiche di superficie, tuttora in corso, rivolte sia alla conoscenza globale delle trasformazioni urbane e territoriali sia a risolvere alcune problematiche specifiche (Figura 4.2). In questo quadro, il progetto è partito dall'analisi sistematica della parte periurbana dei settori settentrionale e orientale, questo ultimo esaminato fino ai rilievi collinari. Le indagini sono completate da ricognizioni sia a campionatura 'ragionata' (ad es. le aree di necropoli e i settori interessati dai resti del sistema idraulico della città) sia *random*, come nel caso degli ultimi interventi nel settore estremo nord-orientale, realizzati con l'obiettivo di produrre un campione esaustivo per la stima della stratificazione sia ambientale sia antropica in aree note ma poco esplorate⁴⁹.

Risultati

Alcuni primi importanti risultati perseguiti, in ambito territoriale, grazie al complesso di strategie messo in atto, riguardano il riconoscimento dell'intero impianto idrico per l'approvvigionamento della città e alcuni spunti di riflessione sugli aspetti problematici di possibili approdi.

L'acquedotto

Le indagini, suffragate anche da verifiche puntuali di scavo⁵⁰, hanno riguardato il sistema di approvvigionamento idrico della città. I resti di un acquedotto furono riconosciuti sin dall'inizio del XIX secolo ad oriente e sulla cortina muraria immediatamente a sud di porta Sirena⁵¹, dove era stata realizzata una breccia per consentirne l'innesto. Dell'impianto idrico si conservano in questo punto pochi resti delle strutture in *caementicium*

dell'elevato, e, sul versante interno delle mura un serbatoio idrico, di forma quadrangolare ($4.72 \times 5.20 \times 3.05\text{m}$), anch'esso in *opus caementicium*, utilizzato per la raccolta e la distribuzione dell'acqua nel centro urbano; altri segmenti della condotta sono visibili, a terra, tra la porta orientale e la stazione ferroviaria. La realizzazione della cisterna e dell'acquedotto sono collocati da H. Schläger⁵² in un periodo successivo all'ultimo ventennio del I sec. d.C., in quanto le fondazioni poggierebbero sui lapilli dell'eruzione pliniana.

È verosimile che l'acquedotto sia stato funzionante sino ad età tardo antica se ad esso è riferibile l'epigrafe, forse risalente alla fine del III secolo, che ne ricorda il restauro ad opera di un *eques*⁵³.

Allo scopo di intercettare e seguire il percorso dell'acquedotto sono state pianificate e realizzate, nel biennio 2005–2006, ricognizioni di superficie a carattere tematico che hanno interessato la porzione orientale della territorio pestano e, più precisamente, il tratto compreso tra Porta Sirena e le sorgenti in località Capo d'Acqua, nel comune di Trentinara⁵⁴ (Figura 4.2). Esse hanno consentito di ricostruirne in gran parte l'andamento (ne sono stati intercettati dodici tratti certi, distribuiti in maniera eterogenea sul territorio, con diverse direzioni e pendenze) sulla base di elementi *in situ* e di altri ipotizzati, di osservarne la tecnica costruttiva e di comprendere le strategie di sfruttamento ed irraggiungimento delle acque. La principale sorgente alimentatrice è stata identificata in località Capo d'Acqua, che nel toponimo esplicita l'importanza dell'area in relazione alle risorse idriche, di fondamentale importanza sino all'età moderna, come si evince dalla presenza di evidenze antiche sormontate da strutture più recenti.

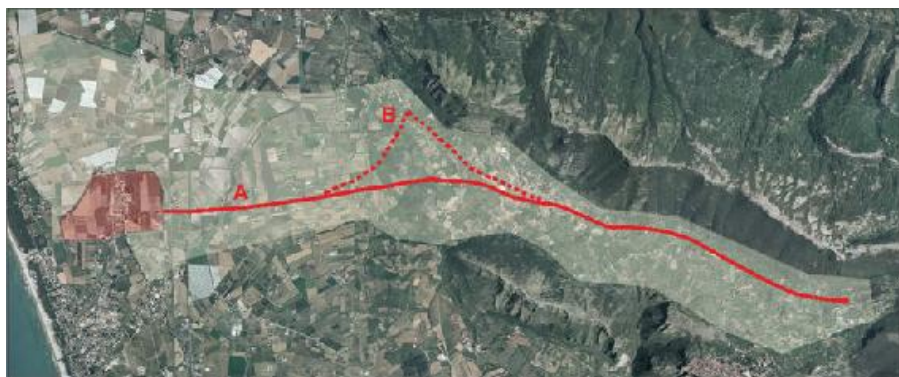


Figura 4.2 Aerofotografia (volo 2000) con indicazione delle aree di ricognizione e del tracciato certo (A) e presunto (B) dell'acquedotto.

I tratti superstiti dell'acquedotto sono in gran parte riferibili ad un canale sotterraneo dell'altezza complessiva di c. 1m, realizzato in *opus caementicium*, con scapoli di calcare legati con malta di colore biancastro e molto compatta, costituito da due spallette parallele sormontate da una copertura voltata, la cui luce misura c. 50cm.

L'interno del canale, visibile in alcuni tratti, si presenta rivestito da uno o più strati di cocciopesto sul fondo e sui lati, che talvolta conservano spesse incrostazioni calcaree, dovute al passaggio dell'acqua salmastra.

Le tracce archeologiche esaminate nel corso della ricognizione permettono di ipotizzare l'esistenza di una struttura sopraelevata che, in alcuni punti, si sostituisce al canale sotterraneo, per consentire di regolamentare al meglio la pressione idrica in modo che i dislivelli naturali non costituiscano un impedimento alla regolare e costante portata di acqua.

A partire dalla principale sorgente, il tracciato può essere seguito con certezza, almeno a grande scala, fino al centro abitato di Capaccio grazie soprattutto al rinvenimento di alcuni tratti in *situ*. Da questo punto in poi, purtroppo, le informazioni materiali dell'acquedotto diventano più rare, tanto che è possibile soltanto supporre il percorso verso la città di Paestum. L'ipotesi più probabile è quella secondo la quale il sifone oltrepassi il forte declivio che separa le città di Capaccio e di *Paestum* in linea retta con un sistema di conduzione misto, basato sull'alternanza di tratti sopraelevati e di sistemi di controllo della pendenza, come vasche e cisterne.

Tuttavia, non possono essere esclusi in modo definitivo altri percorsi né l'esistenza di canalizzazioni, che convogliavano l'acqua di sorgenti minori, e di diramazioni secondarie, che garantissero la presenza di acqua in terreni sottoposti a sfruttamento agricolo.

A proposito della necessità di garantire una pressione costante all'acqua dalla sorgente sino alla città, è significativo notare i due metodi differenti di costruzione.

Infatti, nelle aree a maggiore pendenza e nei punti di taglio del declivio, l'acquedotto corre sotto il piano di campagna in canali ciechi foderati di cocciopesto; invece, nei punti di scarsa acclività, dove è necessario accrescere artificialmente il dislivello per aumentare la pressione dell'acqua, l'opera è sopraelevata, come attestato dai piloni nei pressi della stazione ferroviaria di *Paestum* e dal punto di immissione in città, collocato all'interno della cortina muraria ad una notevole altezza, in corrispondenza del pilone meridionale di porta Sirena.

Scavi recenti, condotti dalla Soprintendenza, hanno rimesso in luce, poche decine di metri ad est della porta Sirena e della stazione ferroviaria, altri imponenti resti delle canalizzazioni dell'impianto idrico (Figura 4.3) che cavalcano, distruggendone l'elevato, un edificio funerario su podio verosimilmente di età tardo repubblicana (Figura 4.4), circondato da sepolture alla cappuccina più tarde⁵⁵.

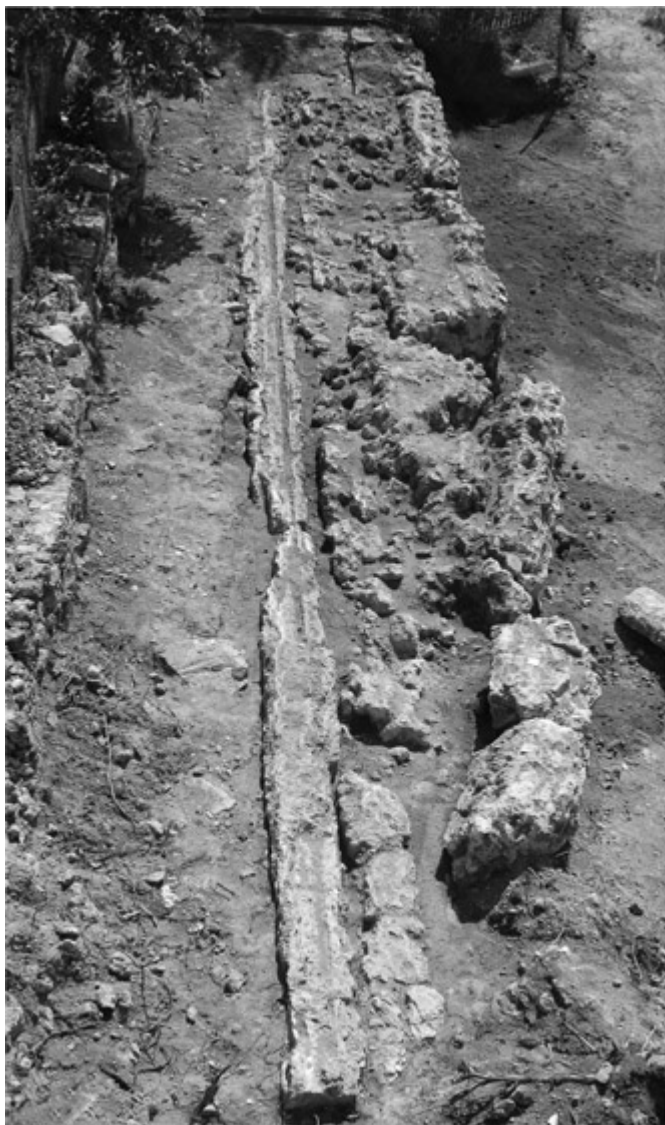


Figura 4.3 Resti dell'acquedotto nei pressi di Porta Sirena.



Figura 4.4 Edificio funerario su podio.

Gli approdi

I risultati di alcuni saggi di scavo coniugati all'interpretazione di scene satellitari effettuata da M. Guy nel 1987⁵⁶ hanno confermato l'esistenza di una laguna, alimentata da sorgenti minerali tra la città e il cordone dunale di Laura, che risulta già interrata agli inizi dell'età imperiale, nonché quella di alcuni canali di comunicazione tra la laguna col mare. Lo studio del più evidente tra questi ha permesso di ipotizzare che la sua parte a valle era navigabile, ma molto prima del 79, fino alla metà del cordone Laura. Su questa duna è stato ipotizzato da M. Guy un vasto insediamento che sparisce assai precocemente (IV sec. a.C.?) quando appaiono chiusi gli sfoghi della laguna o dei canali in relazione alla costruzione del cordone di Sterpina. Lo studioso pensa a numerose installazioni portuali (approdi) successive di cui la più antica nei pressi del cordone abitato su uno dei canali che la foto aerea rileva a nord della torre aragonese e ritiene che, successivamente, mentre si costruiva il cordone Sterpina, il porto dovette migrare o a sud lungo il Solofrone o a nord lungo il Sele.

La consapevolezza della complessità che riveste il problema dei cambiamenti della linea di costa nei pressi di *Paestum* e dei possibili approdi ha reso necessari ulteriori approfondimenti, che, grazie all'integrazione con le indagini geologiche condotte, nel biennio 2008–2009, in collaborazione con il Dipartimento di Scienze della Terra dell'Università 'Federico II' di Napoli, permettono, sia pure in via ancora preliminare di tracciare, limitatamente al tratto di costa antistante porta Marina le tappe dell'evoluzione paleogeografica tra la protostoria e l'età romana⁵⁷. Gli studi hanno messo in risalto che dopo la fase trasgressiva del livello del mare, raggiunta c. 6.000 anni fa, che portò il mare fino all'altezza di porta Marina, si forma un esteso cordone dunare

(Paleocordone di Laura), avanzato di c. 0,6km, che regge alle spalle un'estesa laguna retrodunare (Depressione di Fossa Lupata).

Il ritrovamento di manufatti ascrivibili al VI sec. a.C. e il riconoscimento del *tephra* di Averno (Eruzione dei Campi Flegrei di c. 4.0ka BP) all'interno dei depositi limo-argillosi di alcuni carotaggi, confermano la presenza del sistema morfo-sedimentario di barriera-laguna costiera per l'intervallo di tempo che va da c. 4000 anni fa alla fondazione di *Poseidonia*.

In questo lasso di tempo la laguna sembra già in lento e continuo colmamento e restringimento, anche se essa sembra ancora essere connessa con il mare mediante una o più foci fluviali – oggi resiste ancora quella del Fiumarello – e potenzialmente aver ospitato le strutture portuali e/o gli approdi della fase coloniale. Tale areale, come confermano i dati archeologici, sembrano essere collegati con il mare almeno fino al IV sec a.C., per poi passare ad ambienti decisamente fluvio-palustri, e quindi non più connessi al mare. Infatti, rapidamente si aggrada riducendo fortemente il proprio areale mantenendo condizioni di palustrinità almeno fino all'arrivo dei prodotti distali dell'eruzione vesuviana del 79 d.C. La linea di costa progradita ulteriormente, mediante la formazione di un altro cordone dunare (Paleocordone di Sterpina), più esterno ed addossato al precedente. Pertanto, allo stato attuale della ricerca, le eventuali strutture portuali della città di età imperiale sono da ricercarsi altrove, ovvero nel settore terminale del paleogolfo del Solofrone o nella grande depressione retrodunare compresa tra il cordone di Gromola e quello di Laura raggiungibile sia mediante il fiume Sele sia attraverso più piccole foci fluviali.

Conclusioni

Le riflessioni fin qui sviluppate sono sicuramente non esaustive e, anzi, si aprono a numerosi problemi, tra i quali non ultimi quelli relativi all'intera organizzazione e castrametazione del territorio dalla fondazione della colonia fino al ruolo svolto proprio da *Paestum* nella fase di nascita dei *municipia*. Problematiche fondamentali su cui si è deciso di impostare la ricerca anche ai fini di una completa ricostruzione delle trasformazioni agrarie che hanno interessato l'intero contesto territoriale nel quale ricade la piana pestana.

Notes

- 1 Il contributo è frutto di riflessioni comuni; si devono, in particolare, a Marina Cipriani le pagine 34–37 e a Alfonso Santoriello le pagine 38–41.
- 2 I responsabili dell'attuazione del programma sono, per l'Università degli Studi di Salerno, Angela Pontrandolfo e Alfonso Santoriello e, per la Soprintendenza per i Beni Archeologici, Marina Cipriani e Giovanni Avagliano. Al progetto partecipano studenti della Scuola di Specializzazione in Beni Archeologici dell'Università. Gli interventi sul campo sono coordinati da Serena De Caro e Francesco Scelza, dottorandi di ricerca del Dottorato in 'Metodi e Metodologie della ricerca archeologica e storico-artistica' dell'Ateneo salernitano e da Pietro Toro. Per gli aspetti geomorfologici, e più in generale

- per quelli ambientali, il coordinamento è del geologo Vincenzo Amato. Il coordinamento delle attività di laboratorio per lo studio dei materiali è di Angela De Feo.
- 3 Greco e Theodorescu 1980; 1983; 1984: 287–313; 1987; 1989: 15–22; Greco, Stazio e Vallet 1987; Greco 1988; 1996; Theodorescu 1989; 1992; *Poseidonia-Paestum* 1992; Torelli 1992: 33–115; Torelli 1999; Greco e Longo 2000.
 - 4 I lavori, resi possibili da finanziamenti straordinari, sia nazionali che comunitari, fanno parte di un più ampio programma che la Soprintendenza Archeologica ha finalizzato alla conoscenza e al restauro del circuito difensivo pestano. Essi sono stati condotti in collaborazione con il Dipartimento di Scienze del Patrimonio Culturale dell'Università di Salerno.
 - 5 Krischen 1941: 21.
 - 6 Theodorescu 1992: 518–519; 528–529.
 - 7 Cipriani, Pontrandolfo 2010.
 - 8 Cipriani, Pontrandolfo 2010.
 - 9 Greco e Theodorescu 1983: 30; 47; 66–73; 77–80; Theodorescu 1992: 531–538; Greco 1999.
 - 10 Greco 1999: 3–7.
 - 11 Greco e Theodorescu 1987.
 - 12 Greco 1985; Greco e Theodorescu 1987: 43; 60; Torelli 1992: 74–81.
 - 13 Greco e Theodorescu 1983; Greco e Longo 2000: 85–90; 117–123.
 - 14 Greco e Theodorescu 1983: 70–71; Theodorescu 1992: 537. Tale dato appare confermato anche dai risultati di scavi recentissimi che per questa epoca vi hanno rivelato solo un innalzamento del livello dei suoli condotto tra la fine del II e gli inizi del I sec. a.C.
 - 15 Greco e Longo 2000: 109–116.
 - 16 Bragantini *et al.* 2008.
 - 17 Bragantini *et al.* 2008: 159–188.
 - 18 Bragantini *et al.* 2008: 196.
 - 19 Bragantini *et al.* 2008: 197.
 - 20 Greco e Longo 2000: 171–176.
 - 21 Greco Theodorescu 1983: 50–55; De Gennaro, Longo e Rocco 2000: 131–152.
 - 22 Mello e Voza 1968: 206; 220.
 - 23 Greco e Theodorescu 1980: 32–34; sulla discussa cronologia della Basilica Forense si veda anche: Torelli 1992: 105–111; Theodorescu 1992; Torelli 1999: 101–105; P. Vitti, in Greco 1999: 83–100 e, da ultimi: Bragantini *et al.* 2008: 104–105.
 - 24 Greco e Longo 2000: 174–176.
 - 25 Cantilena 1999.
 - 26 Greco e Longo 2000: 176.
 - 27 Greco e Theodorescu 1980: 65, 73, 84; Theodorescu 1992: 530, 537.
 - 28 Theodorescu 1992: 537.
 - 29 Greco e Longo 2000: 115–116.
 - 30 Bragantini *et al.* 2008: 106. Recenti scavi (2008), in corso di edizione, hanno permesso di ricondurre a quest'epoca anche la ristrutturazione delle case gravitanti sull'asse stradale *AnI* e la realizzazione, da parte di un T. F. Marullus, del relativo impianto idrico. Contestualmente si risistema la *porticus* e agli inizi del II sec. si amplia l'anfiteatro a danno delle *tabernae* all'estremità est della *porticus*.
 - 31 Greco 1999: 29–35 .
 - 32 De Bonis 2006–07.
 - 33 Greco e Theodorescu 1980.
 - 34 Mello e Voza 1968: 220–228
 - 35 De Bonis 2008: 322–330, con accurata disamina del problema dell'abbandono della città.
 - 36 Pontrandolfo 1992: 262–264.
 - 37 Sestieri 1948.
 - 38 Torelli 1992: 107.39 Sestieri 1948.

- 40 Cipriani e Pontrandolfo c.d.s.
- 41 Greco Pontrandolfo 1977, 294–296
- 42 Gasparri 1990; 2000.
- 43 Guy, e Delezir 1992: 463–469.
- 44 Gasparri 2000: 219–224.
- 45 Sulla filosofia e la strutturazione del Sistema Informativo di *Poseidonia-Paestum*: Santoriello *et al.* 2007: 365–368; Santoriello 2009a: 209–214.
- 46 Lo studio delle immagini telerilevate è condotto con la collaborazione del dott. Amedeo Rossi, dell'arch. Ottavio Voza e dello IIASS di Vietri sul Mare (SA).
- 47 Rimandiamo ad un prossimo contributo di illustrare, in maniera più dettagliata, metodologie, aspetti tecnici e risultati delle ricerche in corso nel territorio.
- 48 Sulle tecniche adottate e un bilancio preliminare dei risultati attesi, si vedano: Santoriello *et al.* 2006: 475–479; Santoriello 2009b: 165–168.
- 49 Cipriani e Avagliano 1987: passim
- 50 Ardivino 2008: 897–898.
- 51 Recentemente A. S. Stefan (Stefan 2002) ne ha dato un rapido inquadramento, ipotizzando per il tratto sopraelevato un'altezza massima di c. 5m ed ha effettuato un primo tentativo di tracciarne il percorso.
- 52 Schläger 1964; 1965; 1966–67; 1969.
- 53 Mello e Voza 1968: 178–181; Torelli 1999: 38–40.
- 54 Le ricognizioni, lo studio delle immagini telerilevate e della cartografia storica si sono avvalsi, nello specifico, anche del supporto di O. Voza e di P. Toro.
- 55 Ardivino 2008: 898.
- 56 Guy e Delezir 1992: 463–469.
- 57 Amato *et al.* 2009: 129–135.

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Contemporary Issues in Surveying Complex Urban Sites in the Mediterranean Region: The Example of the City of *Thespiiai* (Boeotia, Central Greece)

J. Bintliff

Introduction

As I am currently completing a monograph, with Anthony Snodgrass and Bozidar Slapšak, on the surface survey of the city of *Thespiiai*, where I have been wrestling with the difficulties as well as immense potential of urban survey, I would like to approach this topic through my own experiences with first surveying and then interpreting this particular long-lived city site. The Boeotia Survey began, like most European surface investigations, as a countryside study, with the initial years 1978–1981 being entirely focused on rural settlement. In 1982 a first collection was made from a large village, Askra, made more systematic in 1985. But it was only in 1985 that we fully evaluated the most appropriate means to survey large complex sites, carrying our new strategy into practice at the ancient towns of *Haliartos* and *Thespiiai* (Bintliff and Snodgrass 1988; Snodgrass and Bintliff 1991). The models available for both rural and urban survey stemmed partly from previous European work but predominantly from North America, where more precise and technical approaches had been developed within the New Archaeology movement (cf. Flannery 1976). If the trials at Askra followed European tradition in starting from existing fields as survey units, the introduction of US scientism led us to favour regular collection units or transects so as to facilitate quantitative analyses. Regular transects worked not only for the rural sphere but could equally be applied to sites themselves, not least urban settlements. The pioneer model for such work was represented by the impressive survey of the city of Teotihuacan in the Valley of Mexico (Millon 1964), where an immense regular grid across the site laid the basis for large-scale mapping and surface finds' recording, significantly followed by path-breaking computer analysis of the results.

By the time that *Haliartos* and *Thespiiai* came into our survey plans, we had decided to adopt as regular a grid as the landscape allowed, and fortunately both city sites were essentially confined to agricultural landscapes

with gently-sloping terrain and few current overlying buildings, allowing easy application of such a formal scheme. The survey plan for *Haliartos* makes our approach clear (Figure 5.1a): large units $50 \times 60\text{m}$ were also subsampled with $30 \times 10\text{m}$ units. The larger Transects were density-counted at 15m intervals and collected as a whole, whilst the smaller Samples were entirely counted and collected from. The adoption here and at *Thespiai* of a nested investigation was due to an absence of published guidelines, firstly on the best way to sample large surface sites, and secondly on the implications of applying variable procedures – gaps that appear to continue in the field survey literature.



Figure 5.1a Two-level survey design for the city of Haliartos.

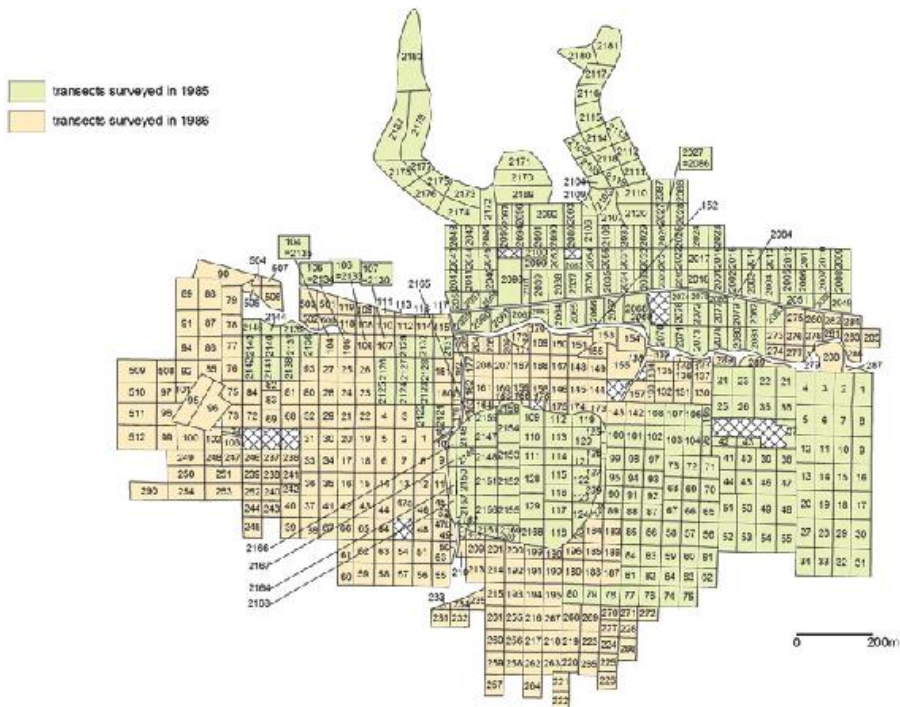


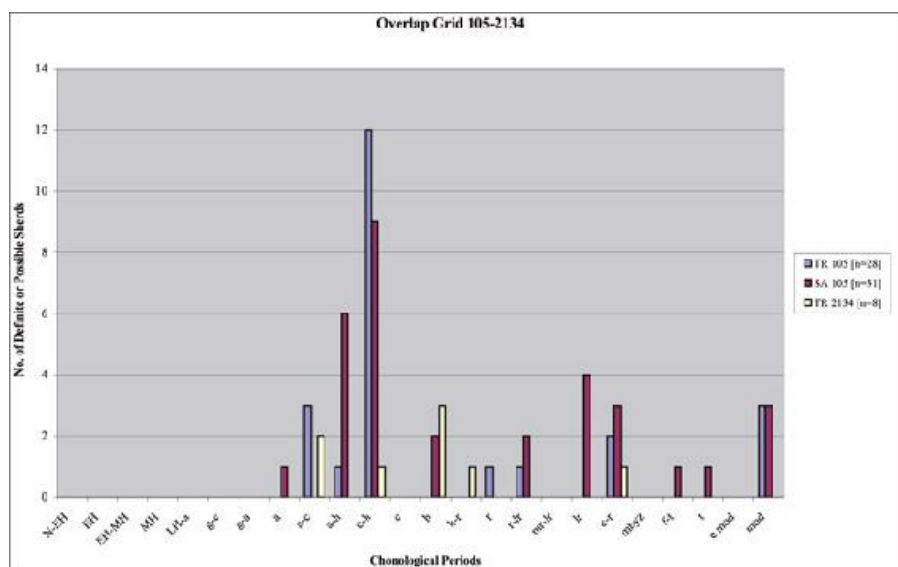
Figure 5.1b The survey grid applied to the city of Thespiai, showing just the larger 60 × 50m Transect units.¹

Approaching Thespiai

This townsite is a rather extreme case in some respects, as intensive cultivation has left few surface ruins to guide survey. This, and the quarrying activities of two adjacent villages, have so damaged subsurface ruins that geophysical tests have failed to reveal any townplan (but did help elucidate one ruin as a church). Aerial photographs also showed nothing apart from confirming the lines of a Late Roman fort, marked on the ground by an earthwork and deviations to farm-tracks. A few ruins also of late antique and medieval date scattered widely across the general area gave no further indications for the infrastructure of the ancient city and successor occupation. Thus, using the long-recorded Late Roman fort or ‘Kastro’ as an anchor, a nested grid was laid out in all directions (Figure 5.1b) with the same dimensions as at *Haliartos*. The field teams collected sherds and took visibility-corrected density measurements for a majority of Transects and Samples, but local farming conditions and other hindrances prevented a full matching of small units to larger and from obtaining such data from all units. Study ceased some distance beyond where the field teams considered surface densities to be ‘offsite’, but it took 606 Transects and a gridded area of 180ha, and two seasons of a month each (involving some dozen students and staff) to complete the ceramic survey.

There was and remains no guideline on the appropriate size for sherd collections, a serious hindrance to sites with massive ceramic debris. We generally gathered far more than was normal for surveys of the 1980s, a total of around 14,000 sherds. Although body-sherds were collected, mostly feature pottery was favoured (rims, bases and handles) for their increased potential for chronological and functional attribution. Interestingly, criticism of this procedure as risking serious bias needs now to take account of our recent experiments in comparing sample to total collection at the city of Koroneia (van der Enden in Bintliff *et al.* in press), where for historic-period sherds no significant new information emerged from collection of all sherds compared to feature pot, with the important exception of cookwares, and prehistoric finds, for both of which in any case special collection procedures are required.

During the gridded survey and during several subsequent years up to 2009, observations were made on building fragments across the town area. In fact, due to agricultural disturbance and weathering, almost every year reveals new pieces. We have deliberately tried to reach separate but then converging conclusions from the potsherds and architecture, adopting the same approach with the sparse historical sources.



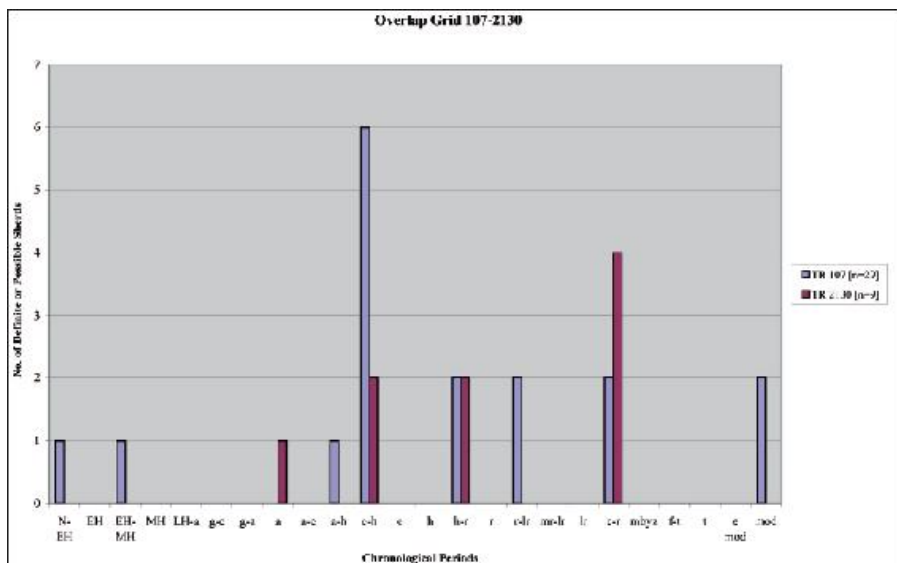
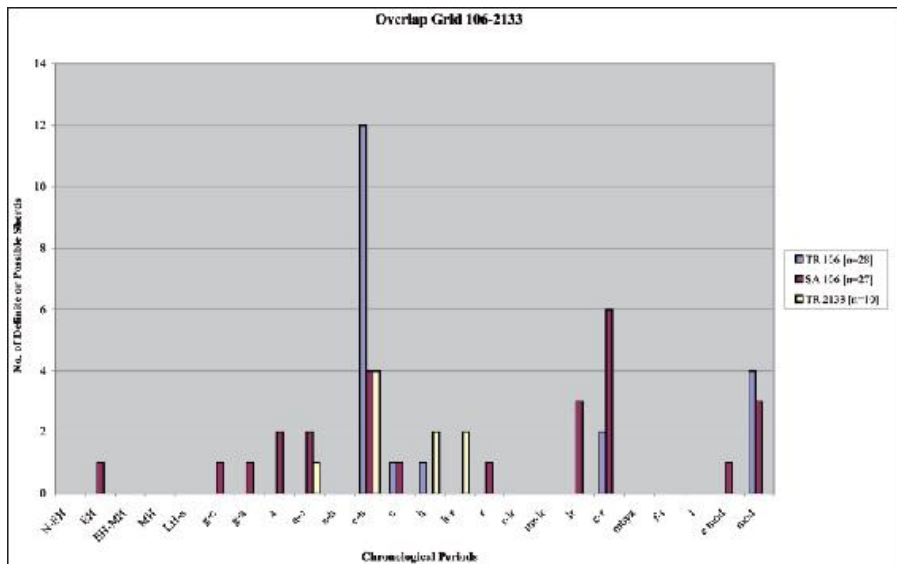


Figure 5.2 Chronological dispersal of the duplicated collections from 1985 and 1986, with sample size indicated. Abbreviations used in illustrations: PREH = Prehistoric, BA = Bronze Age, N = Neolithic, H = Helladic or Bronze Age, g = Geometric, a – Archaic, c = Classical, h = Hellenistic, r = Roman, BYZ = Byzantine, F-T = Frankish/Late Byzantine or Turkish, mod = Modern, e/E and m/M and l/L and F are respectively early, middle, late and Final. The less representative grids are 2134, 2133 and 2130. These were resampled with a larger collection as Tr/Sa 105, Tr/Sa 106 and Tr 107.

Exploring the database

An odd but pertinent question: where are the boundaries of the town – or, more accurately the towns – to allow for the possible changing extent of the urban area? Until 2002 we had no city wall traces, but from then till 2009

renewed topographic study revealed significant elements of ancient fortifications of different periods, which is in itself a warning against short-term project publications being too definitive. The most recent evidence shocked us by revealing an urban extension in an unexpected direction and period, and a theatre also in a place we had never expected to see such. Nonetheless our central concern is rather the spread of genuine built-up occupation, which frequently, and here as well, is far from being coterminous with city wall-lines and public buildings.

With a large database of density counts and of dated finds, it might seem easy to define the occupied area for different eras. For the Neolithic thankfully all but the latest finds came from a known tell-site in the core of the grid, but during the subsequent Bronze to Early Iron Ages the datable sherds are always rare and rather randomly spread across the entire gridded zone. We have already published our theory of a 'Hidden Landscape' where prehistoric finds are often almost invisible in heavily-cultivated landscapes or on sites with massive historic occupational overlays (Bintliff *et al.* 1999). On a city-site where densities are mostly between 2 and 46 sherds per m², and dominated by post-prehistoric components, prehistoric surface finds must be assumed to represent a mere fraction of the original debris. A significant accidental experiment occurred due to our inadvertently collecting from a series of grids twice over, where one sample was small, the other several times larger. Remarkably, in the small collection series, finds were almost entirely of the commonest (Greco-Roman) periods, whilst the same grids with larger collections consistently also produced finds of the minority prehistoric and post-Roman eras (Figure 5.2). Statistical analysis indicates that collections of 30 or less sherds are likely not to produce finds of such rarer periods, a first hint of some numerical guidelines for complex site survey.

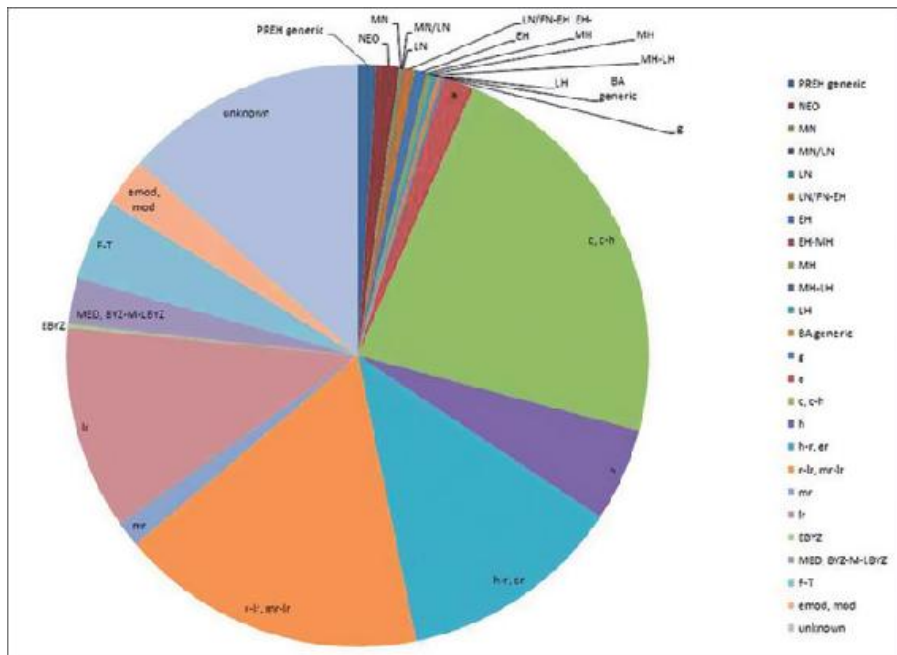


Plate 5.1 Pie-chart of the chronological breakdown of the Transect collections, in chronological order.

The pie-chart of the total Transect sherds (Plate 5.1) raises further issues. Firstly an immense timespan is represented by Early Neolithic to Early Iron Age (g) activity, yet numbers are very low. Medieval and Post-Medieval are however significant. But the vast bulk of the finds come from the historically-attested Greco-Roman town. From c. 7000 BC to the known last occupants of a village on the town-site (early nineteenth century AD) we have multiple activity overlays which now appear in very variable proportions on the site's surface. Clearly this poses difficulties of representativity, arguably biased against the pre-urban prehistoric periods and favouring both the last phases of the town (Late Roman) and at least in some areas the final village occupation of the Medieval-plus centuries. Moreover these numbers have as yet no spatial properties: a more recent phase in one part of the site might produce more surface finds than an older phase which actually covered a larger area but has suffered from burial or degradation.

Insights into the problem of localised variation, to go beyond mere numbers of sherds per phase, come from what we term Sector Analysis, where a large site is subdivided into study units for examining chronological variability. In Plate 5.2, for example, the generic Greek finds appear to form the sides of a hollow basin (Sectors 1, 3, 7, 8, 10), those of generic Roman date fill that central hollow (Sectors 5 and 9), and Medieval and later sherds are focused on the far east Sectors (9, 10). Subsequent analysis from several different forms of evidence indicates that the Greek town was far larger than the Roman, but when the latter shrank to the centre and inner east, its debris

has swamped Greek finds on the surface. The hollow actually appears to have been the city centre in both Greek and Roman times. The medieval-plus villages known historically from the far eastern Sectors, though, do find a good match in the Sector study.

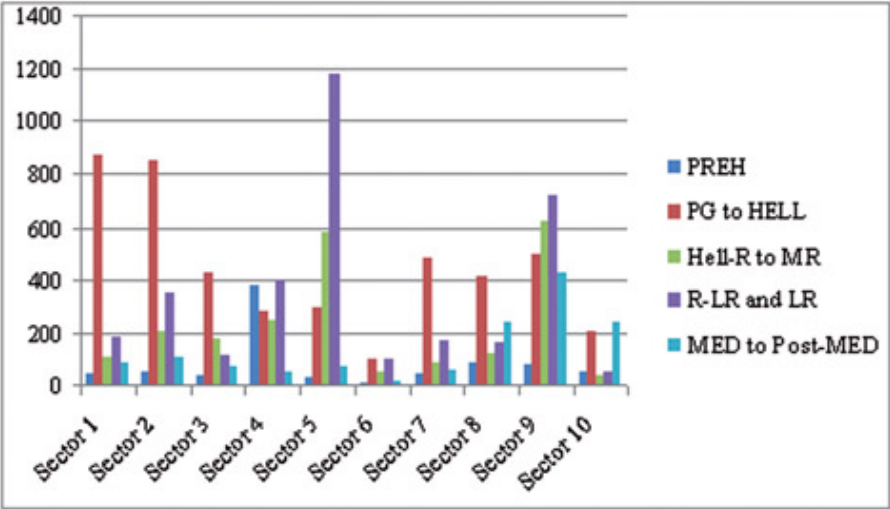
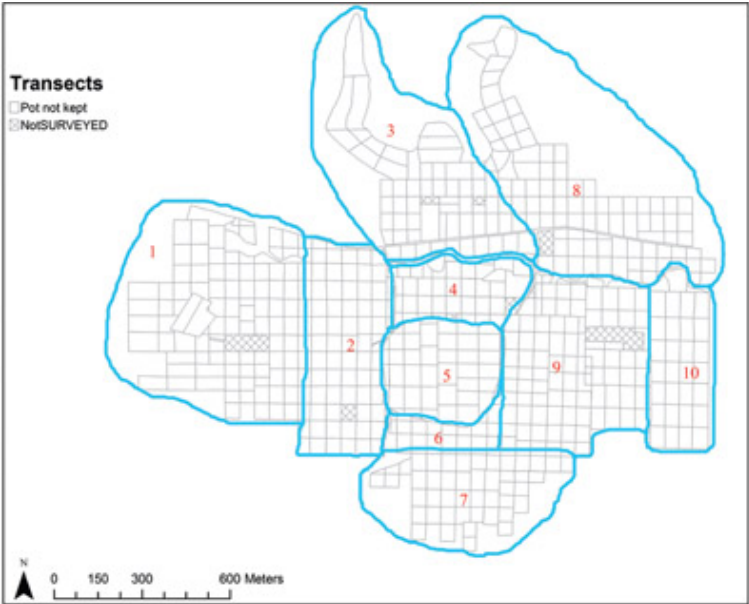


Plate 5.2 The city grid divided into ten Sectors and the spread of dated sherds from combined Transect and Sample collections.

An independent analysis of the total city density map was carried out to propose maximum boundaries for the ancient city. Clear breaks in density offered several possible thresholds for the expected transition from (1) the densely built-up settlement proper, to (2) an extramural activity zone

containing cemeteries, sanctuaries, scattered settlement and rubbish-dumping (the inner halo), and then to (3) a wider impact zone (outer halo) reaching, for Boeotian cities, several kilometres into the surrounding countryside and here largely created by urban-based agricultural manuring (Bintliff, Howard and Snodgrass 2007).

Our initial choices of relevant threshold levels ran up against the problem of finding suitable space for the extramural cemeteries, which, over an urban life of around 1200 years, we conjecture to have contained of the order of 280,000 dead. This forced us to select a more confined core city so as to allow space for this element before density values approximated to the genuine countryside or outer halo (Plate 5.3). At this point we can combine our density-analysis with the evidence for burials, both from diagnostic ceramic finds and actual graves, and with that for the city walls of different periods (Plate 5.4). It is significant that Roman cemeteries and sanctuaries, without standing monuments, are difficult to distinguish from domestic occupation or rubbish-dumping, since their gifts and ritual debris are predominantly comparable to ordinary domestic debris. Greek graves, however, can contain more distinctive tomb assemblages.

In any case a promising fit of our maximum (core) city boundary from density analysis to that from known or likely extramural grave finds, and the fragments of an early city wall and its later extension, can be seen. Some outliers of city level density outside our projected maximum town represent, we believe especially dense ancient burial and other extramural activity, while in the east they also reflect the main area of the medieval and later village occupation. Importantly, whereas the early city wall in the south is likely to be early Classical in date, the extension across the river to the north is probably late Classical to Early Hellenistic. The extra space has only a limited area of dense domestic debris and this does not extend into Roman Imperial times. There are parallels in other Boeotian towns for an optimistic enlargement plan or replanning for cities hostile to the leading regional city of Thebes, after the latter was destroyed by Alexander the Great. The refoundation of Thebes soon after put paid to such schemes, so that at least for *Thespiiai*, Orchomenos and Plataia the city extensions were only poorly and fleetingly occupied.

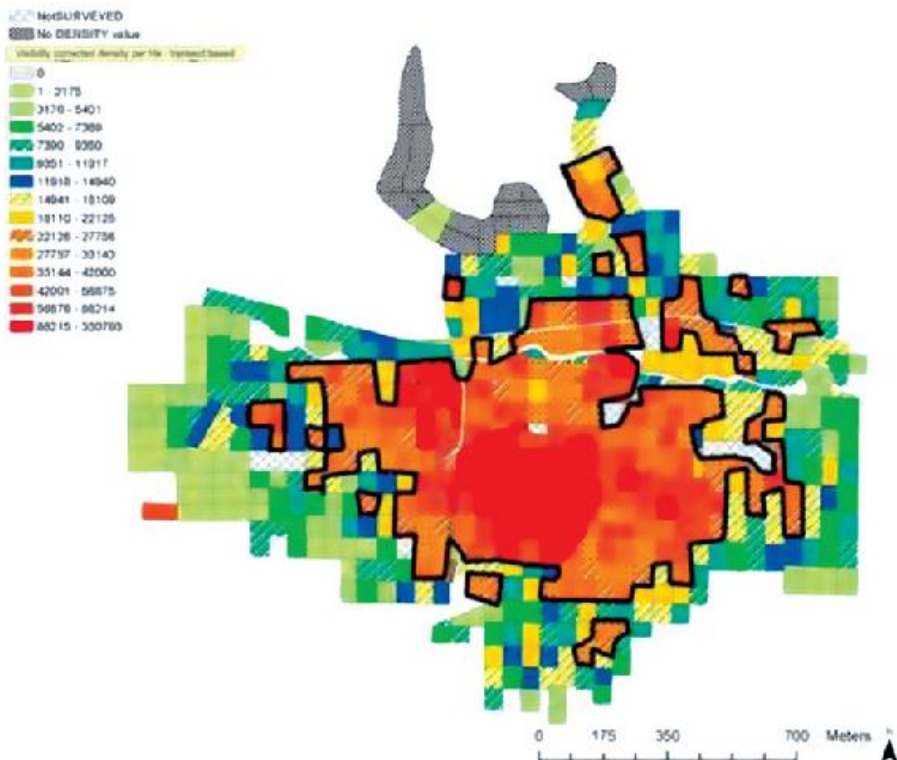


Plate 5.3 Densities for the Transect series, with a dark line indicating levels suggested to be associated with a built-up area of the town or unusually intense/recurrent extramural activities.

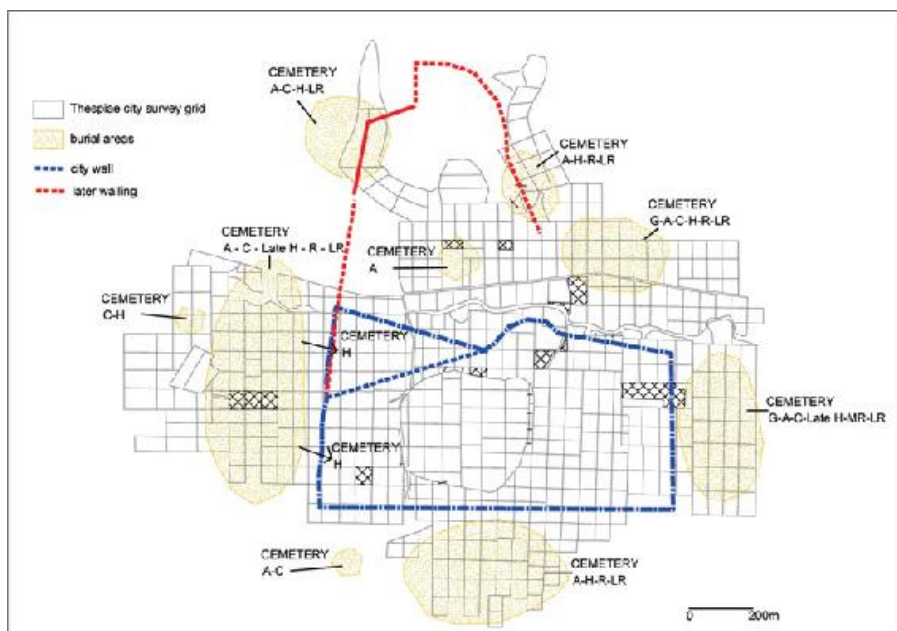


Plate 5.4 The maximum city defined from density analysis combined with indications from

After such complex preparations we can more confidently turn to the plots of period sherds across the gridded area. A Neolithic focused village yields to scattered low-level finds of Bronze Age and Early Iron Age date: sampling and taphonomic problems limit how far we can interpret such early finds. Our provisional suggestion is that no evidence has arisen for a large and populous prehistoric community in these periods, but we cannot easily separate a permanent if low, dispersed population, from another reading seeing such rare but widespread finds as a shifting settlement pattern of farms and small hamlets around the later city site.

The Classical to Early Hellenistic map would be misleadingly read if we had not prepared the ground through the preceding analyses. The evidence that the city centre lay within the later circular Kastro in the centre of the grid, whilst the outermost rings of dense finds indicate extramural cemeteries, gives rise to a very different interpretation than if we had merely focused on high densities as defining the city core. Furthermore, in the grid centre and to its east, lower values mark massive swamping by Roman to Late Roman urban debris, as it is here where the city largely shrank to during Late Hellenistic to Early Roman times. Thus we interpret the city as at maximum extent, some 70ha, in generic Greek times.

Historical sources evidence a village in the eastern part of the grid in Medieval and Post-Medieval times. The Byzantine-Crusader period community on survey actually turns out to be two villages separated by a stream. The dense and wide scatter of finds, even when compared with the Greco-Roman city, suggests at first sight a rather sizeable population. But we must remember that the relevant ceramics are of fine quality, and extremely datable. Moreover, these villages, continuing into the Turkish period, form the last settlement on the site, hence their sherds are least affected by subsequent occupation. Comparative analysis of a series of deserted Boeotian villages of the same eras, allows us to project a likely ratio of core site to a surrounding halo of infield manuring and rubbish disposal, which would constrain these two *Thespiiai* settlements to a total of some 5ha. A suggested community of around 500 people suits our Turkish-period census records.

Finally, the Modern sherd map challenges us not to discard recent finds and even to try to account for them. Current ethnoarchaeological observation suggests that inadequate public waste collection till recently encouraged countryside dumping of rubbish from the two modern villages overlooking the city grid, especially along main tarmac roads and the most popular dirt roads through the farmed landscape. The general patterning of finds agrees with these predictions.

One aspect can only briefly be mentioned here, and that is the comparison of the large and the small study units. At the level of the entire site, their density patterns were very similar, but this falls down at the local detailed

level, and the same occurs with the maps of dated finds for each period. We simply lack experimental or theoretical insights to account for such variation. However, it is not too difficult to see how such contrasts might arise when we focus on the two different scales of survey at the individual grid level. The Transect finds are gathered across a 3000m² area, those of the Samples from 300m² within it. The long-term history of the latter, the size of a typical Greek house-plot (Cahill 2002), will often have seen irregular change of land use, whereas the larger unit, comparable to a city insula, could represent more general trends.

Conclusions

1. Large and complex Mediterranean surface sites pose particular problems for surface survey: the appropriate methodology and the way to interpret the data recovered are still in the early experimental stages.
2. We lack a published body of experimentation regarding critical aspects such as the minimum desirable size of ceramic sample per study unit, the effects on collections of using different site sampling strategies, and the differential effects of taphonomy and recognisability on the quality and quantity of material of different periods at the same site. In these circumstances it is safer to collect large samples from very many grid units so as to allow as much statistical and spatial analysis as possible. Using more than one sample scheme also seems necessary. A provisional calculation suggests that at least 300 sherds of each period are needed to record realistic distributions on a city site.
3. Plots of density variation and contrasted spreads of finds on period maps do not translate directly into site size or the history of occupation. Elaborate filters are required for such synthetic maps, to realistically tease-apart different functional zones within each period and the significance of contrasts between phases of occupation.
4. City projects limited to a few years need to be cautious in creating grand scenarios of their site's history. Regular revisits cause corrections to early interpretations, or, even as in the case of *Thespiiai*, total revisions.

Note

- 1 The computer maps used in this chapter were prepared by Emeri Farinetti, GIS specialist for the Boeotia Project. This Project is funded by Leiden University and the Interuniversity Poles of Attraction Programme of the Belgian government.

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Towards Integrated Non-invasive Research on Complex Urban Sites: Ljubljana Research in Tanagra and Beyond

B. Slapšak

Introduction

In 2000, the Ljubljana University team was invited to join the Ancient Cities of Boeotia Project (ACB) directed by John Bintliff of Leiden University, and run under the auspices of the Netherlands Institute in Athens. The declared aim was to enhance the performance of the then mainly surface ceramic distributions, environment and historical record oriented research, by introducing non-invasive techniques targeting structural remains. After a testing season in Tanagra in the autumn that year (Slapšak 2001; Mušič and Slapšak 2001), the team fully engaged in field research in 2001, focusing on geophysics and geoarchaology (Mušič and Slapšak 2002; Rižnar *et al.* 2002); in 2002, the project became a joint venture between the two universities, co-directed by John Bintliff and Božidar Slapšak, with Kostas Sbonias and till 2006 Branko Mušič as assistant directors.¹ Starting that year, it is also part of a BELSPO-funded Interuniversity Attraction Poles (IUAP) program promoting interaction among Belgian, and between Belgian and European universities, directed by Marc Waelkens of KU Leuven. After Slovenia became member of the EU, the Ljubljana University team could be granted the position of full European partner in the program in 2007. Following upon the excellent results by geophysics, a range of surface features surveys was tested in 2003 (Bintliff *et al.* 2003) and systematically applied between 2004 and 2006 (Mušič, Slapšak and Farinetti 2004; Bintliff 2005; Slapšak and Mušič 2005; Bintliff and Slapšak 2006). Since 2006, the Ljubljana survey moved to the ancient city of *Thespieae*, where a different set of methods had to be deployed (Bintliff and Slapšak 2006; Bintliff *et al.* 2009; Slapšak 2007a; 2007b; 2008; 2010). Our preliminary investigations on the cities of *Haliartos* and *Hyettos*, surveyed as part of the Boeotia Survey Project, and Koroneia, currently surveyed by the Leiden team, are very much based on the study of aerial photo archives and on aerial reconnaissance introduced in 2006, covering also a number of other sites in the general area of the project research, and including systematic ground truthing (Grosman and Slapšak 2007; Grosman 2007; Slapšak and Grosman 2009). In this paper, we will concentrate on the research in Tanagra, bearing in mind that the full range of techniques could be deployed, and the concept of integrated non-invasive

research fully applied, only after we moved to the other sites.

State of the art

While the vast cemeteries of the ancient city of Tanagra have been extensively excavated, first in an organized grave-robbing enterprise between 1871 and 1873, which launched the lovely Tanagrinae on the European antiquarian market (Higgins 1986; Jeammet 2003; 2010; Jeammet and Becq 2007, with further references), then by the Greek Archaeological Society between 1874 and 1911, and lately by the Archaeological Service as part of rescue operations in face of the industrial expansion in the area (Harami 2008, with further references), the only documented excavation within the urban area is that by the Greek Archaeological Society on the acropolis (Kontsas 1890), which brought to light an Early Christian basilica and architectural members of a Ionic temple, believed to be that of Dionisos (by Frazer; see Roller 1987: 227s and fig. 6).

Historical, geographical, literary and epigraphic sources relevant to the study of the topography of the urban centre of Tanagra have been duly discussed (Roller 1988; for a recent overview, see Buck 2003; Fossey 2003, with further references), and so have the descriptions in early travelers (Roller 1988), and urban archaeology (Harami 2008). Besides observations in the seminal work by Fossey (Fossey 1988), the urban structure was first revealed by architectural survey carried out by Roller in 1985 (Figure 6.1), following his doctoral investigations in the 70s (Roller 1971; 1974), and presented on the map published in *BSA* (Roller 1987). Ceramic survey and other operations by the Leiden team on the site of ancient Tanagra and in the countryside were carried out by John Bintliff between 2000 and 2005 (Bintliff *et al.* 2001; 2003; Bintliff 2005; 2006; 2008).

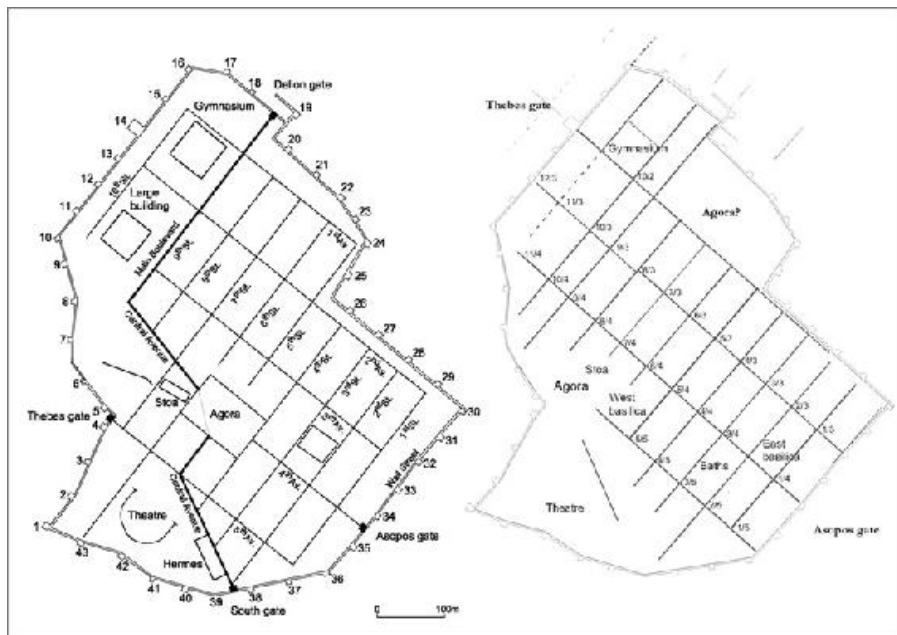


Figure 6.1 Roller's map of Tanagra compared to the map produced by the Ljubljana ACB team (see also Figure 6.2).

Methodology

In terms of field methodology, the Boeotia Survey (CABBAGE, now ACB) was conceived from the beginning as non-invasive (e.g. Bintliff and Snodgrass 1985; 1989), and remains radically so. Although focusing mainly on surface distributions of ceramics, it did occasionally experiment with techniques such as geophysics, targeting structural remains. By 2000, it was ready to incorporate further non-invasive field techniques: the decision to invite the Ljubljana team to join was justified by John Bintliff precisely by the interest of our integrated survey approach as presented in the frames of the Populus project, combining ceramics and slag survey with surface morphology survey, geophysical and geochemical prospections (Mušič *et al.* 2000), and by possible methodological relevance of such approach to research in Greece.

Complex non-invasive research was slow to develop within the ACB framework, however. The main obstacle was very limited funding, which barely permitted to keep up the geophysical team in the field in the first years. Nevertheless, we decided in 2003 to follow up upon the geophysical results and develop the program further by deploying structural and morphological survey, and the study of the distribution of dispersed architectural members; in 2006, general survey, documenting of tomography at destruction sites, and aerial prospection were introduced. While this caused some disruption within the team,² this move was inevitable if we wanted to remain true to our

conceptual credo and avoid reducing the involvement by the Ljubljana team to technical support within the project and program.

The Ljubljana research continues as low cost – high-tech endeavor targeting ancient urban sites, building upon methodological know-how provided for our students as part of the Department of Archaeology undergraduate curriculum. It is very much based on student involvement, both at the level of field training and of research tasks assigned as part of their theses in either methodology or ancient studies, at this point mainly undergraduate (for Tanagra, theses by Rutar 2006; Uršič Blažič 2008).

Integrated survey is conceived here as covering more than one technical field of non-invasive research/investigations (as described e.g. in Sarris and Jones 2000; good overview in Kuna 2004). The term is descriptive in principle, and is commonly used to denote, say, geophysical research deploying any number of techniques: magnetometry, conductivity, resistivity, GPR, seismic prospections, etc., each of them applied in any number of ways/methods – often just in juxtaposition, but also developing complex integration algorithms (e.g. Kvamme 2006). We would argue, though, that where applicable,³ the use of the term is justifiable only if all types of features (surface distributions of artefacts, surface structures and morphology, subsurface features, etc.) are adequately addressed by non-invasive techniques (quantitative surface survey, ground-based and airborne remote sensing, surveying, architectural survey, etc.).⁴

The concept of integrated (non-invasive multi-method) survey thus relates to a much wider range of techniques, and the overall methodology will envisage a reasoned deployment of them all, or of a choice of them for systematic data acquisition at the site studied, by testing, sampling or total coverage. It is typically applied on complex sites such as ancient cities, but also on lesser sites, and on archaeological landscapes. Urban sites vary greatly between them in terms of applicability of non-invasive techniques to be deployed, depending on geological setting, nature of building materials and degree of preservation, and the whole site history, including duration and phasing, degree of urban change, restructuring and recycling in the lifetime, and degradation after abandonment of the site. Unlike regional, urban surveys know nothing like neutral background against which anomalies appear. The picture will tend to be complex, and the tools to address this complexity will be diverse, and adapted to each case under study. While regional surveys, adapted though they are to the specificities of local environments, will tend to follow well defined procedures and strict rules to permit comparability of results, the approaches to urban survey must be much more flexible in choosing among the array of techniques at hand, and take into consideration the variety of conditions between and within sites, to best address the problems to be solved. So flexibility rather than uniformity will be the rule, and that requires a thorough understanding of the options at hand, and of the problems we can realistically explore by non-invasive archaeology.

Where applicable, survey may be further enhanced by excavation programs, but it is important to bear in mind that it is the non-invasive techniques that will permit us to capture data on the totality of the site, and that, as a matter of rule, it is the proper deployment of these techniques that will enable us to meaningfully identify and formulate the questions, which the site can realistically answer, with or without the use of invasive techniques. Integrated noninvasive archaeology is an indispensable part of any project including excavation, but is by no means just an aid to orient excavation, and can productively formulate research without recurring to excavation.

In addressing research on complex sites, initial testing is important for assessing the potential of the techniques to be deployed. In some cases, existing documents from previous research will make the choice rather obvious, and may even present adequate base document to orient all further research on the site. The term 'base document' developed within the ACB project is about choosing the technique/document capable of providing sufficient information on the totality of the site, to enable planning the best and most cost-effective, targeted use of further techniques in the process (Figure 6.2). The decision on the base document will thus result from a reasoned consideration, often including testing, of the properties of the archaeological record to be studied, and of the capacity of the techniques at hand and the resulting data layers, to enable as quickly as realistically possible informed discussion on the array of possible problem-oriented strategies to follow within the project.



Figure 6.2 The base document – magnetometry map of Tanagra (B. Mušič).

While the base document will, wherever possible, cover the totality of the site under study, and will, typically but not necessarily, derive from some form of remote sensing, the research strategies agreed will require the deployment of further techniques either by total coverage, sampling, or testing. Remote-sensed data may lead to testing by further remote sensing techniques (e.g. infrared in aerial photography, GPR or electric tomography in geophysics). In any case, data layers by each new technique deployed will be analyzed against all previous data layers. Typically, any ground based surface features survey will thus serve as ground truthing⁵ of remote-sensed data, whatever its extent (testing, sampling, total coverage). The point there is that all ground truthing will be done by competent specialists, in close interaction

with the specialists that produced the document ground truthed, and not as an appendix to the work of specialists in other fields (e.g. geophysicists alone ground truthing archaeological surface features). In much the same way, surface survey results (e.g. by ceramic or surface morphology survey) can at some stage be enhanced by deploying further surface surveys such as architectural, building material distribution, or other survey. In all cases, ground truthing can and should be conceived within integrated non-invasive research not just as an exercise aimed at resolving gray-spots in remote-sensed or other data, but as part of a more complex problem-oriented research derived from previous results.

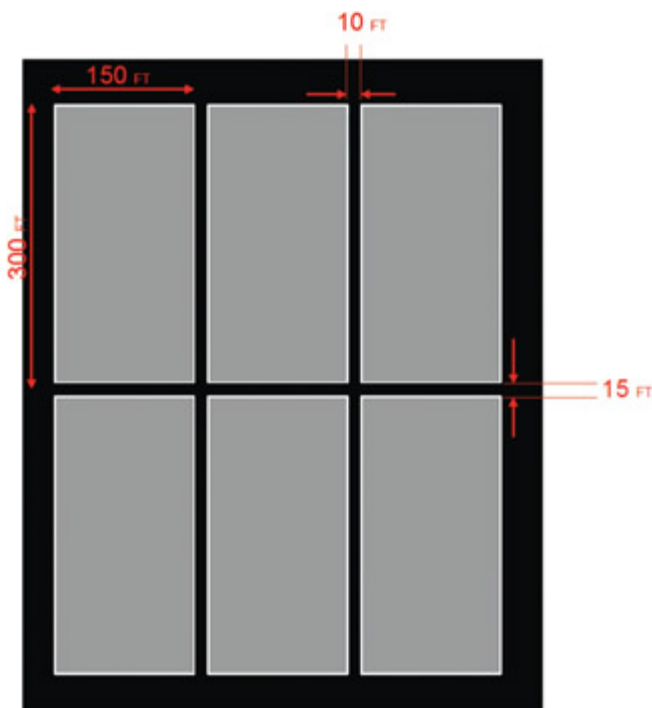


Figure 6.3 The modular structure of the urban grid (G. Rutar).

At each of the three urban sites studied by the Ljubljana team in the frames of the ACB project, a different technique provided the base document to orient further survey. In Tanagra, magnetometry gave a most reliable map of the urban structure with rich detail on key architectures. In *Thespieae* only the ceramic distribution map by Bintliff and Snodgrass permitted to address the questions of the limits of the ancient city and of urban dynamics, and to develop strategies to solve problems formulated thereupon by further techniques. Unlike the site of Tanagra, which is now fully protected (at least within the late city walls), that of *Thespieae* is intensely cultivated, while the newly discovered acropolis is part of the actual village of Thespies. Consequently, very traditional forms of archaeological survey had to be added to the panoply of research methods, including interviews with the locals,

noting oral traditions and observations of archaeological interest. Furthermore, building activities within and around the village, in the area of the ancient city and of its cemeteries, permitted us to identify a number of destruction sites: with the consent by the Ephorate of Prehistoric and Classical Antiquities, we cleaned the sites and documented their stratigraphy, which proved of utmost importance for the study of the topography of the ancient city. We would argue that cleaning and documenting destruction sites should be part of the standard survey procedures, and that the survey teams should be equipped and ready to do the work, whatever the necessary interaction with the Archaeological Services, very much the same way they will clean and document standing structures. Such cleaning will only make damaged surfaces readable in archaeological terms, and will never entail removal of archaeological layers – that would only be possible as part of excavation, under appropriate permit. In *Haliartos*, last of the ancient city sites studied, it is the aerial photography that revealed the urban structure, and is orienting further targeted research by geophysics and architectural survey.



Figure 6.4 The two grids compared on the base document.

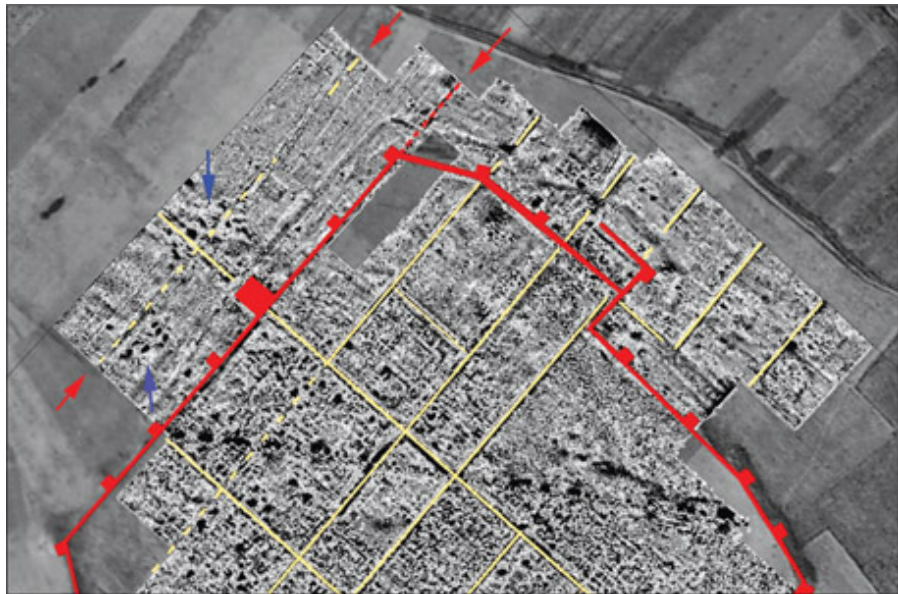


Figure 6.5 Detail of the northernmost part of the ancient city, with the Classical grid extending beyond the late Roman wall (magnetometry B. Mušič).

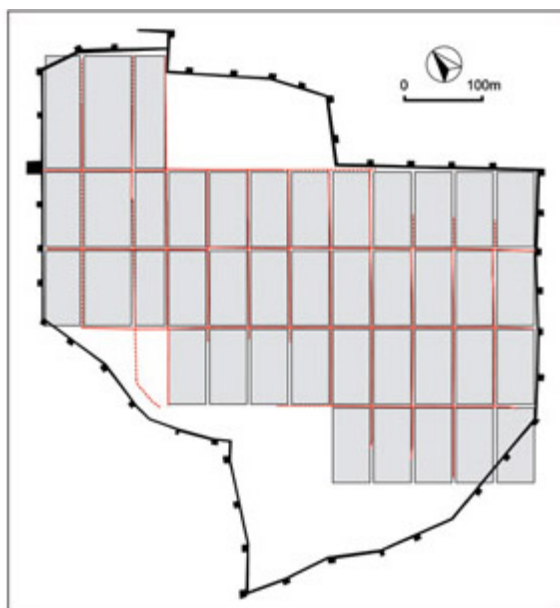


Figure 6.6 Deformations of the urban grid (G Rutar).

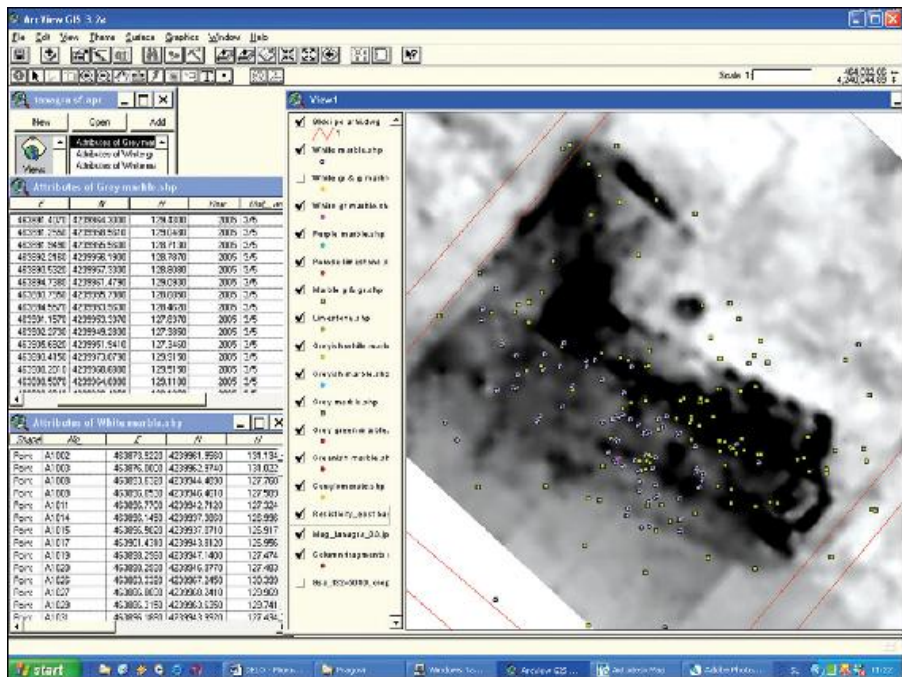


Figure 6.7 East basilica, distribution of architectural fragments (K. Uršič Blažič), with database, on resistivity map (B. Mušič).

In view of this diversity, guidelines such as those that must be elaborated to make student participation in field data acquisition and processing efficient, will vary between sites greatly. For Tanagra, a manual was first drafted in 2004, and then fully elaborated in 2005 (Slapšak and Rutar 2005). It concerned surface features survey, building upon the magnetometry map as the base document, which at that point covered the major part of the walled city. A number of operations were pragmatically defined: for each of them, the target was identified (city block fronts, city wall, architectural fragments, etc.), goals were explicated, and procedures described. Practical instructions for field teams were added for all of them, as well as for operations common to all (e.g. the combined use of GPS and TS surveying to ensure maximum and equal locational precision of each point on the features studied). Thus the target area potential assessment was about identifying on the map any features of interest and transferring related points to the ground, so as to enable observation of the features in the field and assessment of their information potential and readability by various techniques. City block fronts survey was the operation actually carried out on the major part of the city. The crossroad points were read on the map and transferred to the ground thus permitting to define regular city blocks in the field, any remains of front walls were identified, cleaned, and photogrammetrically documented, with the goal of identifying the geometry of the urban grid, observing deformations in the layout of the grid and proposing explanations, and identifying the metrology

and the modular structure of the grid (Figure 6.3). Other operations were tested on samples of blocks and architectures chosen for their special interest as read from the magnetometry map.

Results

The quality of the base document and the high precision of field recording in ground truthing over the whole area of the ancient city permitted to make necessary corrections to the map of Tanagra published by Roller, and explain the reasons for inconsistencies in his output (Figure 6.1). Frankly, if we were limited, as Roller was, to architectural survey only, and did not have the magnetometry map to build upon (Figure 6.2), we would have probably done no better: architectural remains are just not preserved well enough to permit unequivocal identifications. His reconstruction of the measure of the urban block at 100×150 feet (*c.* 30.5×45.7 m) could be confirmed (Figure 6.3): what changes is the overall urban structure, where we can see a different rhythm of the Streets in the westernmost part of the lower city, possibly dictated by the width of the Gymnasium there, and a different position of the Avenues (Figure 6.4); the Grand Boulevard is not there, and the Agora is not where he would have it, but rather further west of his location, south by the great Stoa.

There is another large open space in the north, tentatively named Lower Agora, cut across by the City Wall, which we now know to be Late Roman and not Classical as Roller assumed. Remains of the Classical wall were found north beyond the protected area, below the regional road, and the urban grid shows well on magnetometry between the Late Roman and Classical North walls (Figure 6.5). The urban grid and the line of the City Wall, apparently surveyed separately by Roller and not adequately put together, are now properly synchronized, so the Avenues end at towers and the Thebes and Asopos gates as now identified fit the grid well. A number of public structures can be read in the base document, including Roman baths and at least two sizeable Early Christian basilicas.

City block fronts survey provided us with high precision locational data, which permitted analyses well beyond Roller's reconstruction of the size of the urban block. The basic unit of measure applied was identified reliably as the 'common' foot of 316mm, the width of the Streets measured at 10 feet, that of the Avenues 15. There are slight deformations in the grid, which may obscure the picture at some places, but we can see the logic behind these deformations, and propose reconstruction of the procedure by ancient surveyors (Figure 6.6). Further operations such as Architectural Fragments Survey gave useful results over the east basilica and the Roman baths, confirmed neatly the functional identification from the base document, and provided some clues for dating (Figure 6.7). Targeted prospections by a range of geophysical techniques gave good detail on a number of architectural units

(samples of housing units, sections of the upper and lower agora areas, part of the west theatre parodos and skene, gymnasium, Early Christian basilicas, industrial quarters with kilns) (Figure 6.8).

Conclusions

In terms of historical interpretation of the urban structure, Roller suggested that the urban grid as detected was the result of the grand new plan for the city after the destructions of the Peloponnesian war, consistent with the principles of the fourth century BC urbanism, contextually to be dated to the 70s of the century. Nothing in our new observations contradicts such interpretation: new arguments to be added are the change of the rhythm of the streets in the west of the lower city, adapted to the dimensions of the gymnasium of the type datable to the fourth century BC, possibly also the concept of the lower agora (details to be studied from future targeted survey there), and the foot standard. Precise dating will for the moment remain in the domain of the discussion of historical context.

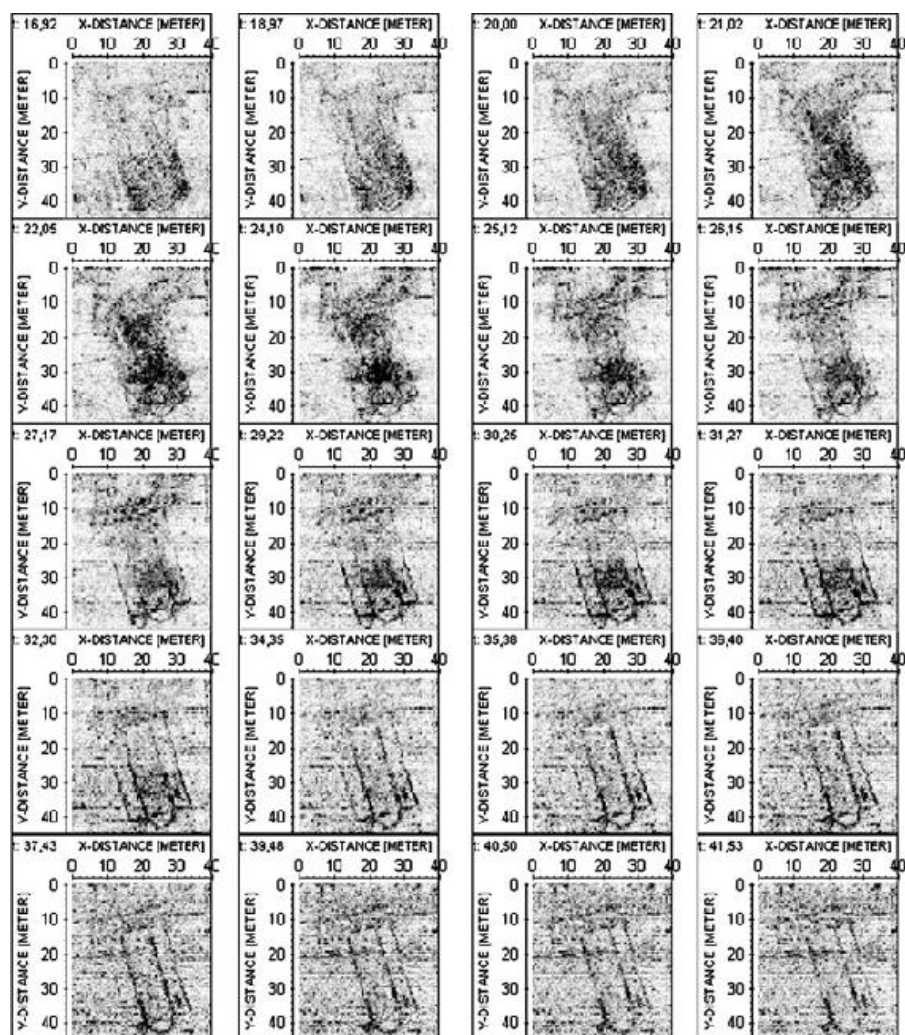


Figure 6.8 East basilica, GPR tomography (B. Mušič).

The concept of integrated survey as applied in Tanagra, and further developed in Thespieae and Haliartos, is based on the panoply of techniques and methods which, adequately structured, make non-invasive research a powerful tool of archaeological investigation in its own right. It has great potential on complex sites such as ancient cities: for one thing, it addresses the totality of a site, targeting urban complexity at a different spatial level than excavation. Precious, indeed inevitable as it may be in helping the excavator avoid spending time and energy on unproductive plots, and target areas of special interest detected, the urban survey is more than just an ancillary exercise: it will lead to important breakthroughs and clarifications also when conceived as basic research independent from immediate excavation and heritage projects. Now is the time to engage in this type of research programmes.

In the case of Tanagra, the results of the urban survey, however low budget, are rather impressive. Still, its potential only has been tackled, and more questions have been put forward than replies given. We should hope that there will be a follow-up to the Ljubljana research, and the joint Leiden-Ljubljana endeavor at this site; there is much left to be done before any excavation is considered there.

Notes

- 1 Further Ljubljana scholars involved in the research include Darja Grosman, Predrag Novaković, Dušan Kramberger, Andreja Maver, Brigita Petek and Andrej Bilc. Among the Greek or Greece based colleagues involved or consulted at various stages, there are Athanasios Rizakis, Andreas Vassilopoulos, Niki Evelpidou, Helene Simoni, Kostas Papagiannopoulos, and Tony Kozelj; aerial reconnaissance is made possible through friendly collaboration with the Slovenian ultralight aircraft company Pipistrel representative in Greece Michalis Anastasiou and his crew. The research is very much based on student field training, valuable contributions were made especially by Gašper Rutar, Tonka Šoba and Katja Uršič in surface features survey, and in geophysics by Matjaž Mori, Uroš Kirn and Rok Plesničar. The team has enjoyed continuous support from the 9th Ephorate of Prehistoric and Classical Antiquities (Vassilis Aravantinos) and the 23rd Ephorate of Byzantine Antiquities (Eugenia Gerousi).
- 2 The geophysics team of Branko Mušič stopped its collaboration in 2006; since then, geophysical prospections are carried out with the help of the students interested to specialize in the field; Branko Mušič continues to work for the Sagalassos project in the frames of the IUAP program.
- 3 Admittedly, in some environments such as paved areas (typically squares and courtyards) in modern urban centres, deployable survey techniques may be limited to a narrow choice, often within geophysics only.
- 4 Depending on the concept of research and the nature of research permit, low-invasive techniques such as drilling/coring or shovel pits can be deployed; we are not discussing projects here, which can afford excavation of any extent as part of the research algorithm, primarily because we deem it important to develop and structure methodologies to fully exploit the potential of non-invasive research first.
- 5 The term ground truthing, rooted as it is in the domaine of satellite remote sensing related operations, applies nicely to all airborne remote sensing, but should to our opinion be applicable also to the truthing of ground based remote sensing results by observation of surface features, and possibly to other operations testing survey results (Slapšak and Grosman 2009).

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Strategies and Results of the Urban Survey in the Upper City of *Ephesus*

S. Groh

Introduction and state of the art

Topographic investigations have a long tradition in *Ephesus* (Figure 7.1). The first generations of researchers from the seventeenth to the early twentieth century had a trained eye for the as-yet undisturbed, unexcavated terrain of the ancient city. They created precise maps and plans of the monuments and topography, using the means available to them at the time (Wheler 1689; Falkener 1862; Wood 1877; Schindler 1896).

In the second half of the twentieth century, however, the focus of research at *Ephesus* shifted: now attention was paid in particular to individual monuments in the supposed centre of imperial-period *Ephesus*. The new ‘comprehensive plans’ of the years 1962–95 reflect this situation (Scherrer 1995). They are only concerned with the partially or completely excavated monuments and sections of streets, without reference to the entire urban area inside the Hellenistic-Roman city walls. In 2005 a new geodetic recording of individual monuments and of the southern section of the city walls was undertaken for the first time.

Parallel to the excavations carried out between 1950–2000, considerations regarding the structure of the Hellenistic-Roman city were also made. From this work four different street grids emerged, which were, however, each limited to individual regions of the city and which were based on the excavated monuments of different chronological periods. The most recently discussed urban model by P. Scherrer is based on two different grids of Hellenistic and Roman origin, which were believed to have existed next to each other in the so-called core area of the city (Scherrer 2001).



Figure 7.1 The location of Ephesus.

The research tradition of the last 50 years, based on individual monuments, and the exclusion of further urban regions within these considerations, resulted in a new research approach after the year 2000.

Methodology

In the years 2000–6 the Austrian Archaeological Institute carried out a new research project in the Upper City of *Ephesus*, an area until then only minimally considered. The goal of this project was primarily the analysis of the city area to the east and south of the so-called State Agora (Upper Agora) by means of using modern, non-invasive methods of field archaeology (Groh 2006).

It was already clear at the beginning of the project, however, that the development of this region cannot be discussed independently or in isolation from that of the remaining Ephesian urban area. This led to the extension of field research beyond the defined project space of the Upper City also to the Lower City, the western, middle and northern parts of the city and the outskirts in the east (Figure 7.2).

The methodological approach of the Upper City Project is holistic, that is, the primary focus is not new surveying or new investigation of monuments, but instead the aim is complete recording of large-scale surface areas with the goal of creating a DEM (Digital Elevation Model) and an inventory and analysis of the visible archaeological objects in a GIS (Geographic Information System) (e.g. Gaffney *et al.* 2000; Keay *et al.* 2000; Mitchell 2003; Keay *et al.* 2005; Rabbel *et al.* 2006; Müth 2007; D'Andria *et al.* 2008; Vanhaverbeke *et al.* 2008) (Figure 7.3).

The mapping is intentionally carried out not by geodesic, but by survey teams consisting of two archaeologists and a GPS-surveying system (Global Positioning System) in the field with a Notebook, for which two GPS-receivers (Leica System 530) and a Notebook fit for fieldwork (MicroPC Pen

P5 from Microport) are used. Between 2000–6, an area covering 231.5ha was investigated using the methods described above. The areas surveyed were distributed over the Lower City from the Theatre up to the northern slope of Bülbüldağ (Figure 7.2) up to the height of the Lower Agora, over the Upper City with its flanking slopes, until far to the east over the city wall and the flood plain lying in front of it. The survey of the western city area began along the canal and Harbour and extended up to the western debouche of the Bülbüldağ, the Kaleburun Tepe. In the course of the survey, 54,448 points were mapped, including 6089 architectural elements, 609 wall traces and 88 tomb buildings.

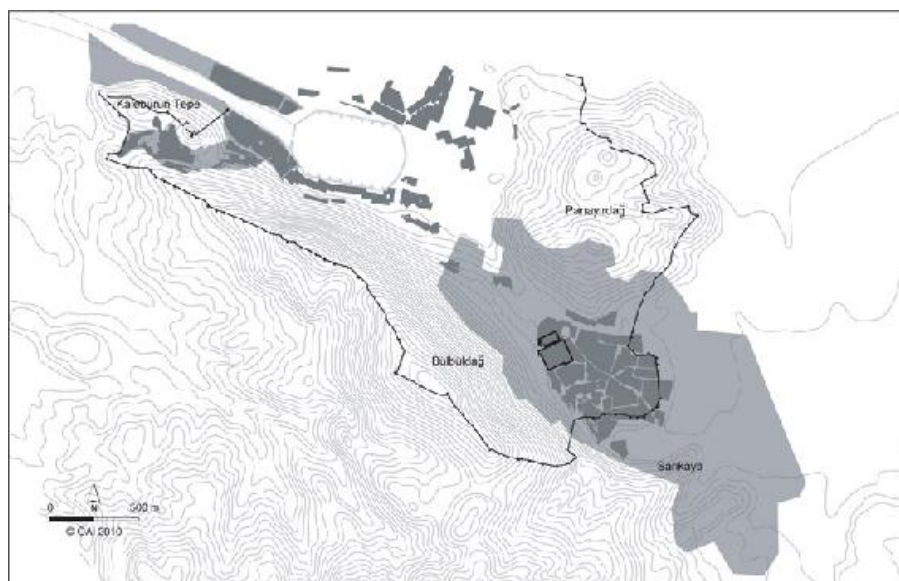
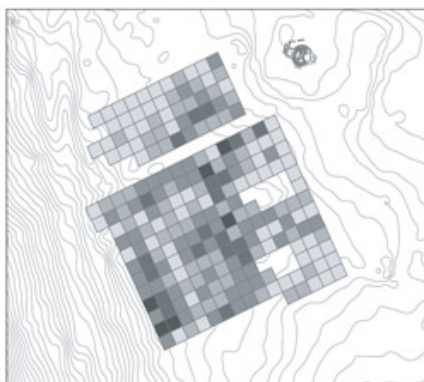


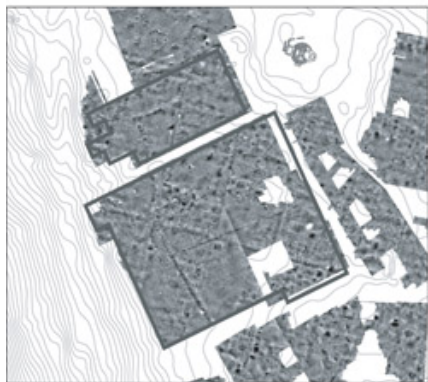
Figure 7.2 Urban surveys in Ephesus (2000–6): GPS (grey), intensive survey (line) and geophysics (black).



1



2



3



4



5



6



Figure 7.3 Strategies of the urban survey in Ephesus: (1) GPS survey; (2) intensive survey/distribution of diagnostic finds; (3) magnetometer survey; (4) interpretation of magnetometer survey; (5) radar survey; (6) interpretation of radar survey.

The second methodological approach is the carrying out of extensive geophysical surveying using radar and magnetic methods. From 2000–5 these surveys were made in cooperation with ZAMG, Archeo Prospections® (Vienna), whereby a surface area of 52.2ha was investigated using caesium

gradiometer and in part using GPR (Ground Penetrating Radar). Since 2006, the geophysical surveys have been undertaken independently by the project team using Fluxgategradiometers and GPR.

The goal of the geophysical surveys in the Upper City was primarily to obtain evidence regarding the street grid and building grid, and secondarily to make statements regarding the structure of individual surface areas of the city (Figure 7.4). The surveys in the western region of the city led to clarification regarding the development of the western foothill of the Bülbüldağ and the neighbouring harbour area. By means of small-scale surveys on the northern slopes of the Bülbüldağ, the Roman city plan reconstructed up to that point should be verified.

The third methodological approach is the carrying out of intensive surveys by collecting surface finds. In November 2003, an intensive survey was undertaken in the western part of the Upper City over eight *insulae*, including a systematic collection of surface material from two neighbouring freshly ploughed fields over an area of 2.28ha.

The goal of this survey is to compare ground plans recognisable from the geophysical prospections with the surface material, in order to be able to make statements concerning the chronology of the development. The impact of hillside erosion and agricultural usage on the distribution pattern of the surface material should also be investigated. For the first time in *Ephesus*, and in exemplary fashion, the significance of surface material in a level developed area should be studied, and the methodological approach to survey projects in an urban area of a Mediterranean metropolis should be illustrated (Bintliff and Snodgrass 1988; Martens *et al.* 2008; Vermeulen 2008). A comparison of the data from the surface survey and those from the finds survey should indicate with which survey method interpretable results can be best obtained.

The experiences which will result from this survey should constitute a foundation for future research projects involving the collection of finds at *Ephesus*. For the Upper City of *Ephesus*, for the first time it should be possible to make concrete statements regarding the intensity, the development, and the end of settlement activity.

The collection of finds took place within 10 × 10m quadrants (grids) each with three collectors. The entire corpus of collected material, mostly pottery (c. 160,000 pieces), will be quantitatively recorded in connection with the field work, and counted and weighed whilst still in the field; architectural ceramics (c. 24,000 pieces) and wall rubble (c. 13,000) will only be counted in the field. From a total number of 155,356 finds, 5053 diagnostic ceramic finds or 3% of the total number, and 48 coins, were recorded in the database and analysed.

An important result is that comparable find distributions of diagnostic and not more specifically definable find objects confirm the methodological approach of the survey, and allow a representative picture of the find distribution to be constructed, even with the small amount of only 3%

diagnostic pieces compared to the total number (Keay *et al.* 2005: 67–8).

Results

As a result of the research project in the Upper City of *Ephesus*, an inventory of the surface architecture is now available, as well as the interpretation of the geophysical survey data. We have produced a register in catalogue form of the individual *insulae*, which we have nevertheless neutrally described as ‘civic areas’ (Groh 2006: 50). A ‘civic area’ is bordered on four sides, and the corner coordinates define the area in the GIS. All the finds within a civic area have been managed in the GIS under this category.

The GIS analysis of the data in the region of the Upper City have provided interesting new insights into the urbanisation of *Ephesus* from the Hellenistic up to the Byzantine period. These include considerations regarding the topography, infrastructure and development in the plain and on the hillsides to the north and south. The civic areas are analysed according to their position within the urban area, and their orientation (compass points, solar radiation, direction of view towards open plazas). At this point a few results may be presented.

It is evident that only a very few areas are level, and a north-northeast orientation is preferred. This orientation guarantees less direct sun during the summer months. Areas with a south- or southwest orientation were predominantly built up with public buildings.

A mapping of the water conduits as well as of individual clay pipes, which were in part discovered in their original locations (*in situ*), as well as the channels visible in the GPR data, reveals that the Upper City was provided with water from two main conduits. Drainage occurred by means of a network of channels beneath the streets towards the east. Fountains and wells possessed an important distribution function (Figure 7.5).



1

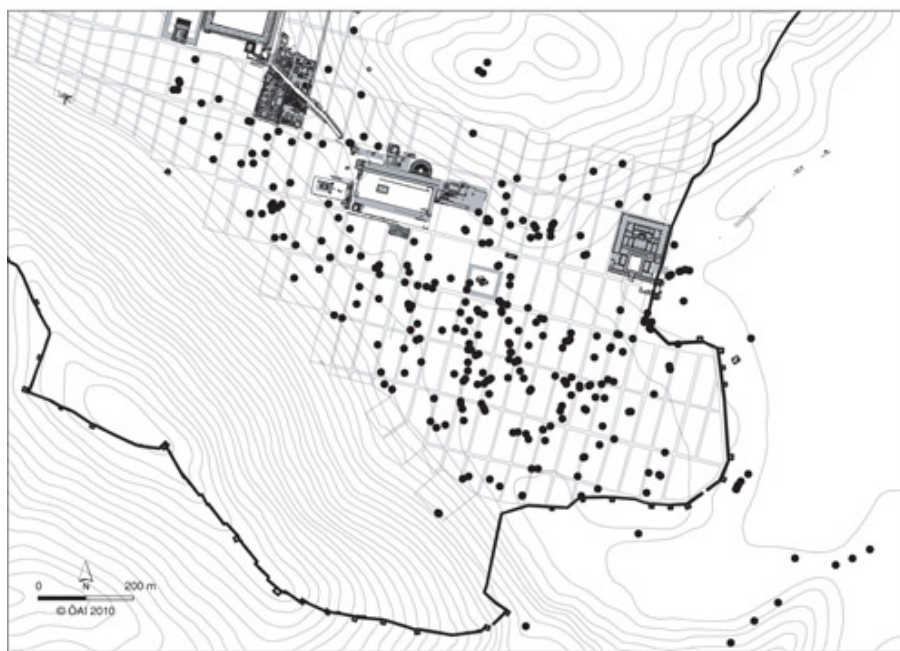


2

Figure 7.4 (1) Magnetometer and radar survey in the Upper City of Ephesus; (2) interpretation of the magnetometer and radar survey in the Upper City of Ephesus.



1



2

Figure 7.5 Distribution of water conduits/clay pipes (1) and columns (2) in the Upper City of Ephesus.

The analysis of the remains of walls documented on the hillslopes shows the preferred slope (up to 30° of gradient) and the uppermost border for development in the urban region which was also targeted by the water

conduits. In the plain, naturally, hardly any wall outcrops exist; here the geophysical survey data provide important evidence regarding development.

A comparison of the mapped columnar architecture (namely columns, bases, consoles, architraves) and elements from room fixtures (for example marble slabs, door thresholds, mouldings) produces an almost exclusive picture: the columns are predominantly strewn across the level plain and on the lowest slopes of the hillside, with a concentration identifiable to the south of the large open plazas. Here the geophysical data also indicate the presence of representational architecture. The elements from room fixtures, on the other hand, are present right up until the uppermost steep slopes. Wall architecture (walls and rubble from walls) is strewn equally across the plateau and over the slopes. Does this pattern of distribution reflect a representative architecture on the plateau, with colonnaded streets and pergolas, in contrast to the domestic architecture on the slopes? The distribution pattern on the plateau is also influenced by agricultural usage (high quantity of finds along the field borders).

The distribution of the Hellenistic and Imperial surface finds, revealed by the intensive survey in a smaller area in the western part of the Upper City, provides evidence of a relatively equal dispersion over the entire survey-area, considering erosive processes. This suggests an extensive development of the region at this time. The Late Antique find distribution reveals a significant increase in finds compared to the Imperial period, and the greatest quantity of finds date to the earliest, i.e. Early Byzantine, period. This distribution pattern is, however, of particular importance for the urban development of *Ephesus*, since it indicates now for the first time an extensive usage of the investigated area in the Early Byzantine period.

Starting from the results in the Upper City, a new model for the entire city of *Ephesus* has been produced. This is based, on the one hand, on the analysis of the survey data, and the collocation of excavation data of all monuments and street sections, from the history of research at *Ephesus*. A new nomenclature has been developed for all city regions, streets, necropoleis and environs of *Ephesus*; this nomenclature primarily follows topographical principles (e.g. northeast necropolis, northwest road), and the urban area *intra muros* has been divided into regions according to functional criteria (Regio I–III).

As one of the results of this work, a new plan of the Hellenistic-Roman city of *Ephesus* was presented in 2006 (Groh 2006: 52–104). Furthermore, the geomorphological studies which have been published to date regarding the alteration of the landscape around *Ephesus* have also been consulted in considering the urban development (Kraft *et al.* 2007). The location of *Ephesus* in a natural bay at the mouth of the River Caystros led to the permanent threat of the silting up of the harbour. This silting up had a decisive impact on measures of urbanization in the city. In the Archaic-Classical periods the *Artemision* and the area of the later *Ephesus* lay directly on the

coast; in the Hellenistic era, however, only the natural bay in *Ephesus* still possessed direct access to the sea. This was the reason for the relocation of the city with its harbour towards the west. In the Roman period, the harbour and the access to the sea were protected by means of dams in the north, and a canal was excavated through the marshy land to the open sea.

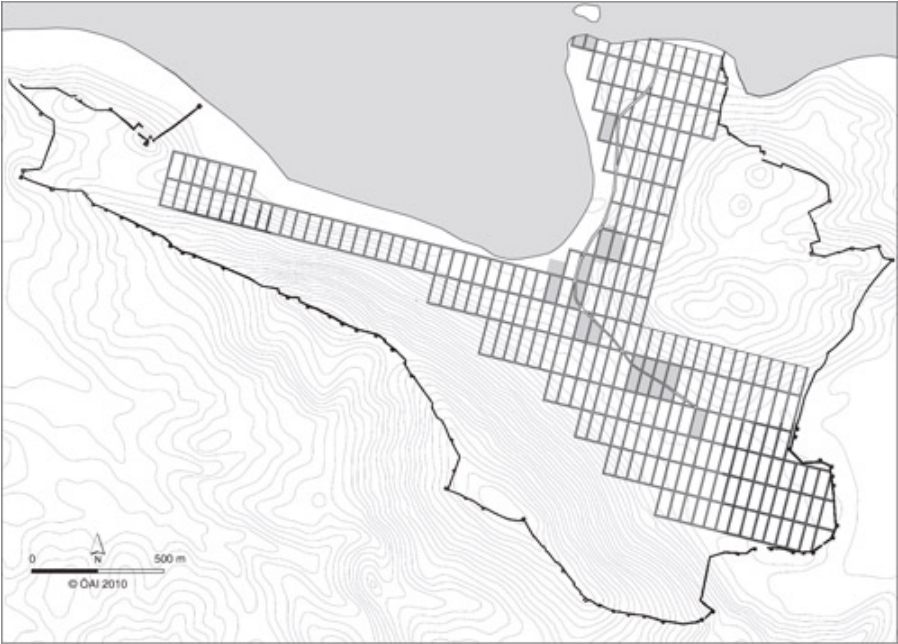
The archaeological evidence indicates a Hellenistic survey- and street-grid for *Ephesus*, which was laid out over all of the regions inside the city wall circuit which were suitable for building (Figure 7.6, 1). An 8.5km long city wall surrounded the city area and the entire bay of *Ephesus*. Out of the 314ha city area inside the city walls, c. 130ha of built-up land or approximately 40% was laid out with an orthogonal street grid.

The Hellenistic grid is based on very simple proportions and built upon a square building plot. The city surface areas of the grid are consistently 104m in length. The row of city surface areas was clearly accentuated with the city centre (the Upper City), where the Upper Agora attained a one-third greater length of 136m (Figure 7.7). The trading centre, with its Lower Agora, lies directly at the harbour. The streets running east–west were set out as *Plataiai* with 5m, and the northwest running streets, with 3m, as narrower *Stenopoi*. The Processional Way, clearly wider with a width of 8m, is preserved over its irregular course, an exception being the final section before the eastern city gate; in general it intersects the city surface areas diagonally.

The nomination of *Ephesus* as the capital city of the Province of Asia gave new impulses to the urban development. As already in the Hellenistic period, the extension of a functioning harbour provided the occasion for construction measures in the Lower City (Figure 7.2). Three regions can be functionally differentiated: *Regio* I with the majority of public buildings, the new city area in the plain and a residential section in the Hellenistic street grid; *Regio* II with the residential section of the Hellenistic tradition; and *Regio* III, the Harbour quarter. The construction of the new Lower Agora, which was connected to the Harbour by means of a colonnaded street and a monumental gate, dates to the Augustan period.

The Processional Way was upgraded to a colonnaded street. The alterations to the street grid are correlated with the newly-acquired levelled terrain in the Harbour plain and in the western area of *Regio* III. The flood plain was made accessible by very wide colonnaded streets in an east–west direction, which certainly had the same orientation as the Hellenistic *plataiai*, but did not lie any more in the same grid. The Hellenistic sequence of 104m long city areas, interrupted by only one longer city area row, was now reversed, and the new city area rows were all, with one exception, 136m long; furthermore, they no longer followed a uniform survey grid, but instead the new street grid. This last point is indicated by an axially symmetrical development of the land, with streets of differing width. Gateways at both ends of the colonnaded street separated the area from the rest of the urban region. The determining axis for the layout of the new city section is Street

33, which runs through the West Gate of the Lower Agora to the south of the Harbour bay up to the westernmost region of the city. To the north, Street 31 is again integrated into the Hellenistic grid. Within the new city area, representative public buildings, areas for the Imperial cult, and economic structures around the Harbour were exclusively built.



The grid of streets and buildings of the remaining civic region persisted, and was occasionally adapted for the erection of large-scale plazas. This parallelism between two survey grids was emphasized by means of building details, so for example the temples of the cult precinct in the lower city make reference to both grids. At the northwest end of the city, a new trade centre with extensive colonnaded halls or horrea (granaries) rose up. The streets outside the city wall were extended and paved, and integrated with the long-distance trade routes. Substantial necropoleis accompanied the extra-urban streets.

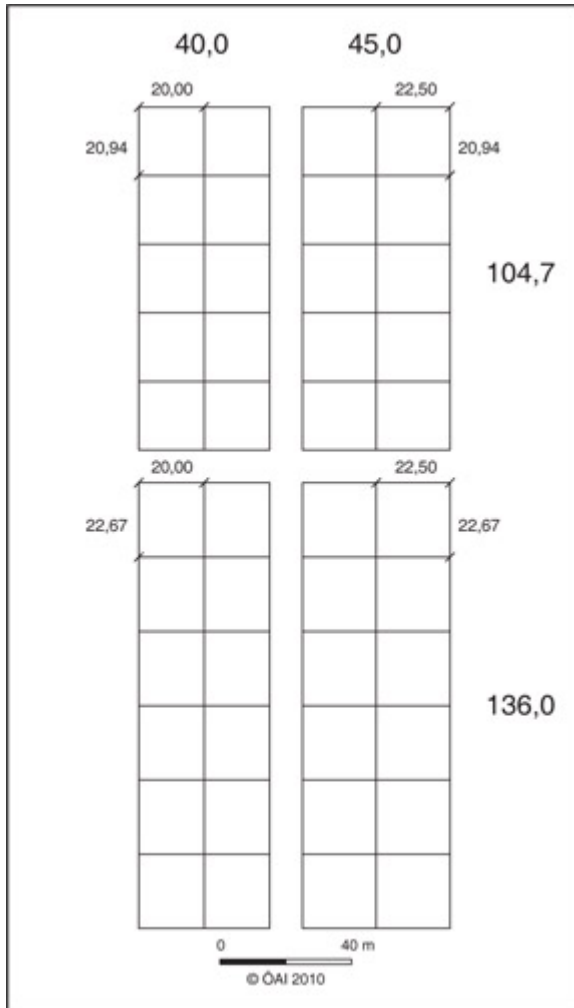


Figure 7.7 Structure of civic areas (insulae) of Hellenistic/Roman Ephesus.

Scientific research on finds in the region of the Processional Way, and a few isolated excavations, convey only a very vague impression of the density

of the belt of tombs around *Ephesus*. According to topographical criteria, the northwest, northeast, east, and southeast necropoleis can be distinguished.

The structure of the necropoleis corresponds over large areas to that of streets of tombs, along which individual tomb buildings were erected. In the surroundings of the streets of tombs, the cliffs of the city hills were terraced and were thickly built up with tomb structures. Based on the southeast necropolis, it can be shown that, in a similar fashion to the orthogonal intraurban street grid, the cliffs as well were regularly developed, i.e. the 15–20m wide terraces run in parallel courses and are connected with narrow passageways.

During the course of a GPS-survey, the southeast sector of the southeast necropolis (Sarıkaya-Hill) was extensively gone over and all of the tomb buildings visible on the surface were mapped. Based on the terracing and the known tombs, it can be assumed that this section with an area of c. 4ha already contained a total of 490 tomb buildings (chamber tombs).

If one extrapolates this number to all necropoleis in *Ephesus*, there are at least 6000 above-ground, visible tombs with at least 20,000 burials to be expected for the Roman city. In addition, there is an untold number of simple graves, cremation burials with and without grave goods or tomb reliefs, and free-standing sarcophagi.

The developed surface areas in the grid within the city walls extend over an area of 166.5ha, while the total city area in the Roman period within the city walls amounts to 314.5ha. The necropoleis comprise at least 56ha, representing thereby one-third (34%) of the inhabited city area and one-fifth (18%) of the entire city area.

Conclusions

The methodological approach of the survey at the Upper City of *Ephesus* since 2000 has resulted in important new conclusions regarding the scale, structure and chronology of the Hellenistic, Roman and Byzantine town. The combination of the methodologies, GPS-surveys, geophysics, intensive Survey and GIS analysis of the data in the region of the Upper City have provided interesting new insights into the urbanisation of *Ephesus*, the *metropolis Asiae*. The picture of *Ephesus* so far, one which has been based primarily on excavated monuments, can now be fundamentally revised. For the first time, an image of a city with individual city quarters, plazas, residential development, and a grid plan typical for planned Hellenistic/Roman cities is emerging. The dimension and significance of the Ephesian harbour is being underscored by new research. Furthermore, it has been possible to obtain data regarding the boundary of development on the hill slopes, and important new information regarding the water supply of the city. Based on the number of the newly discovered *insulae*, even the former considerations concerning the population figure of *Ephesus* in the Roman

period must be adjusted. When one previously believed that there were up to 250,000 inhabitants, now at the most up to 100,000 individuals are likely to have lived within the city walls in an area of *c.* 170ha with *c.* 300 insulae. This research project can be viewed as an instigator for new, fundamental work in the future, focussing on detailed questions regarding the historical topography of *Ephesus*.

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Indagini multidisciplinari per la ricostruzione del paesaggio urbano: ricerche sulla topografia antica di *Hierapolis* di Frigia

G. Scardozzi

Introduzione

Il progetto di ricognizione topografica dell'area urbana di *Hierapolis* di Frigia (Pamukkale, Turchia sud-occidentale), finalizzato alla realizzazione della carta archeologica della città ed allo studio del suo impianto urbano, è stato avviato nel 2003 dall'Istituto per i Beni Archeologici e Monumentali del Consiglio Nazionale delle Ricerche (IBAM-CNR), nell'ambito delle attività della Missione Archeologica Italiana diretta dal prof. Francesco D'Andria¹. Le ricerche sul campo (ancora non ultimate) sono state condotte nel corso delle campagne 2003–2004 e 2007–2009 (Scardozzi 2007a; 2008; D'Andria, Scardozzi e Spanò 2008: 25–30; Scardozzi c.s.)², con la collaborazione di studenti, specializzandi e dottorandi in topografia antica dell'Università del Salento³.

L'antica città di *Hierapolis* di Frigia sorge su un terrazzo di travertino posto subito a nord-est del moderno villaggio di Pamukkale (Regione di Denizli) e proteso sull'ampia e fertile valle alluvionale del fiume Çürüksu, l'antico *Lykos*, affluente del Meandro (D'Andria 2003; D'Andria, Caggia 2007; D'Andria, Scardozzi e Spanò 2008). L'area urbana (c. 70 ettari), circondata da estese necropoli, si estende all'incirca tra quota m 350 (margine ovest) e 425 s.l.m. (limite est), occupando una superficie pianeggiante nella parte occidentale, ad ovest della grande *plateia* su cui è impostato l'impianto ortogonale della città, ed un leggero pendio in quella orientale (Figura 8.1). L'intero settore occidentale ed il ripido pendio che scende verso la valle del *Lykos* (con un salto di quota di c. 50m) sono coperti da bianche formazioni calcaree prodotte dalle sorgenti termali poste al centro della città, le cui acque non furono più regolamentate dopo il declino di *Hierapolis* a partire dall'epoca medio-bizantina.

La storia della città, fondata nel III sec. a.C., è stata segnata da alcuni devastanti terremoti che ne hanno anche condizionato le principali fasi di trasformazione urbana; *Hierapolis*, infatti, sorge al di sopra di una faglia

sismica ancora attiva, che è all'origine dei vari fenomeni naturali che caratterizzano il sito. Dopo un rovinoso terremoto avvenuto nel 60 d.C., tra i decenni finali del I e la prima metà del III sec. d.C. vi fu un periodo di intensa monumentalizzazione, in cui la città si estese verso nord ed anche verso sud, seppure in misura minore.

Un'altra importante fase di trasformazione si verificò successivamente ad un rovinoso terremoto che colpì *Hierapolis* poco dopo la metà del IV sec. d.C.: gli interventi che ne seguirono coincisero con la sua trasformazione da città pagana, il cui culto principale si identificava fino ad allora nel Santuario di Apollo posto al centro dell'area urbana e smantellato proprio in questo periodo, a fervente centro cristiano, con la costruzione del *Martyrion* di S. Filippo su una collina subito a nord-est dell'area urbana e con l'edificazione di numerose chiese e di una cinta muraria (di cui fino ad allora *Hierapolis* era priva) che delimitò una superficie inferiore a quella di età romana imperiale, lasciando al di fuori del perimetro le estremità nord, est e sud dell'abitato. Un ulteriore devastante terremoto, alla metà del VII sec. d.C., segnò l'inizio del declino della città, che non seppe riprendersi come organismo unitario ed andò destrutturandosi; *Hierapolis* continuò comunque a vivere fino al XIII–XIV sec., con una popolazione fortemente ridotta e concentrata in alcuni nuclei.

La Missione Archeologica Italiana opera a *Hierapolis* dal 1957 e nel corso degli anni è intervenuta, con attività di scavo e di restauro concentrate su vari complessi monumentali, come il *Martyrion* di S. Filippo, il Teatro al centro della città, il Santuario d'Apollo, il tratto settentrionale della Via di Frontino, l'*Agorà* Nord, l'*Insula* 104, le Terme Grandi, il c.d. Grande Edificio e la Necropoli Nord. È mancato, fino al 2003, uno studio topografico generale finalizzato alla ricostruzione dell'impianto urbano e delle trasformazioni che lo hanno interessato dall'età ellenistica a quella medio-bizantina e selgiuchide, in cui fossero esaminate in un quadro unitario sia le aree di scavo che tutti i monumenti ed i settori della città e delle necropoli ancora non indagate sistematicamente. Solo Paolo Verzone (1977; 1978: 392–396) si era occupato, tra il 1969 ed il 1971, dello studio, peraltro non sistematico, dell'impianto urbano, identificando gli incroci degli *stenopoi* con sondaggi mirati ed anche grazie a riprese aeree oggi non più disponibili; venne così individuato lo schema generale del tessuto ortogonale di *Hierapolis*, che risulta impostato su un'ampia *plateia* orientata nord-ovest/sud-est e con *stenopoi* minori che delimitavano isolati rettangolari di c. 29.60 × 75m (100 × 250 piedi attici).

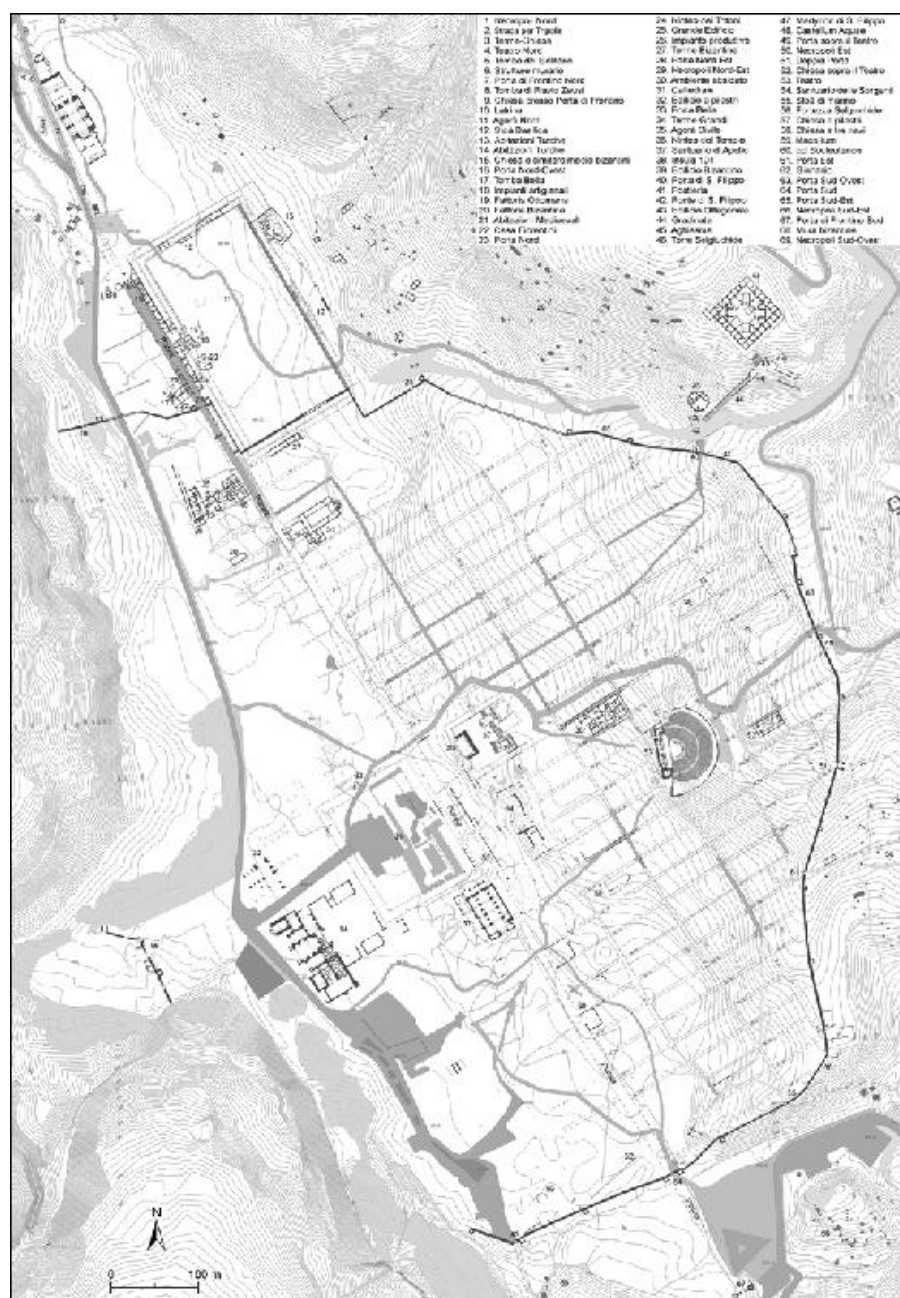


Figura 8.1 Planimetria generale di Hierapolis (da D'Andria, Scardozzi, Spanò 2008, con aggiornamenti).

L'assenza di specifici lavori sulla topografia antica di *Hierapolis* e sulla ricostruzione del suo paesaggio urbano si riflette anche nelle planimetrie archeologiche della città pubblicate fino al 2003 (Verzone 1978; Spanò 2002, tav. f.t.; D'Andria 2003: 44), in cui l'elemento architettonico (con i monumenti dell'area urbana e della necropoli) prevale su quello archeologico

(limitato alle aree di scavo e poco più) mentre le basi cartografiche utilizzate non rappresentano in modo sufficientemente dettagliato e completo la morfologia del terreno, soprattutto sul lato occidentale, in corrispondenza del ripido pendio che dal terrazzo su cui sorge la città scende verso la sottostante pianura del *Lykos*.

Metodologia di ricerca

Le ricerche sulla topografia antica di *Hierapolis* sono state basate anzitutto sulla ricognizione sistematica dell'area urbana, condotta seguendo la suddivisione in *regiones* ed *insulae* (riferita allo schema individuato da Verzone, integrato con le nuove acquisizioni), e delle necropoli circostanti, distinte a seconda della loro posizione geografica in rapporto alla città⁴. Le ricognizioni (non ancora ultimate), hanno anche previsto il rilievo topografico (con Stazione Totale e dal 2008 anche con GPS differenziale) di tutte le strutture murarie esterne alle aree di scavo e dei monumenti ancora non indagati, e sono state integrate da altri sistemi d'indagine di superficie, in particolare l'utilizzo delle immagini da satellite ad alta risoluzione e le prospezioni geofisiche.

Fin dal 2003, le riprese ottiche ad alta risoluzione del satellite QuickBird-2 (www.digitalglobe.com), che sino al 2007 era la piattaforma che forniva immagini con la maggiore risoluzione geometrica per uso civile (60cm nel pancromatico e 2,40m nel multispettrale), hanno integrato l'apporto delle fotografie aeree, scarsamente disponibili e per lo più limitate a riprese oblique dell'area urbana, effettuate dall'elicottero o dal pallone frenato (D'Andria, Scardozzi e Spanò 2008: 25–30; Scardozzi c.s.-a). Nel corso degli anni è stata pertanto acquisita una ricca documentazione multi-temporale (che per la città è costituita da riprese del 2002, 2005, 2006, 2007 e 2009), efficacemente utilizzate in tutte le fasi della ricerca, dalle attività sul campo, all'elaborazione e gestione dei dati, fino alla presentazione dei risultati. Le immagini, che hanno fornito per la prima volta una veduta planimetrica complessiva della città e del territorio circostante, sono state impiegate, grazie alla loro risoluzione spaziale, per individuare tracce ed anomalie riferibili ad elementi archeologici sepolti o semi-affioranti, costantemente verificate a terra al fine di precisarne l'interpretazione e determinarne, ove possibile, la cronologia. Le immagini hanno anche evidenziato vari elementi paleo-ambientali, contribuendo alla ricostruzione del paesaggio antico; nel caso di oggetti o complessi archeologici visibili in superficie, le riprese, per le loro caratteristiche di veduta d'insieme, sono state inoltre utilizzate vantaggiosamente a fini di documentazione, caratterizzazione spaziale e contestualizzazione. Con le stesse finalità, per evidenziare le tracce e le anomalie riferibili ad evidenze archeologiche e paleo-ambientali sepolte, si sono sfruttate anche le caratteristiche spettrali delle immagini, che coprono una porzione dello spettro elettromagnetico comprendente il visibile ed il

vicino infrarosso: sono state pertanto applicate diverse tecniche di *enhancement*, sono state realizzate elaborazioni multispettrali (come per esempio il *colour composite RGB* e l'applicazione del *Normalized Difference Vegetation Index* e della *Tasseled Cap Transformation*) e sono state testate alcune tecniche di *data fusion* (l'algoritmo di Zhang, *Gram-Schmidt Spectral Sharpening*, *HSV Sharpening*, *Colour Normalized (Brovey) Sharpening*, *Principal Components Spectral Sharpening*)⁵.

Molto importanti si sono rivelati anche il confronto e l'integrazione delle immagini satellitari con le riprese aeree oblique, particolarmente efficaci per documentare le evidenze archeologiche, rendendo meglio comprensibile l'articolazione topografica dei complessi monumentali; a tale scopo, nel 2008–2009 sono state realizzate due coperture sistematiche di tutta l'area urbana, effettuate a bassa quota con un sistema di ripresa da pallone aerostatico frenato.

Oltre alle immagini satellitari QuickBird-2, nel corso delle ricerche sono state utilizzate anche una stereocoppia ripresa nel 2004 dal satellite Ikonos-2 (www.geoeye.com: risoluzione spaziale di 1m nel pancromatico e 4m nel multispettrale), una stereocoppia acquisita nel vicino infrarosso (risoluzione spaziale 15m) sempre nel 2004 dal sensore ASTER (*Advanced Spaceborne Thermal Emission and Reflection Radiometer*) del satellite Terra (asterweb.jpl.nasa.gov) ed i dati della *Shuttle Radar Topography Mission* (www2.jpl.nasa.gov/srtm), tutti impiegati per realizzare modelli digitali del terreno con risoluzione alta e media⁶. Su questi DEM sono state georeferenziate sia le immagini pancromatiche che le elaborazioni multispettrali, al fine di associare le tracce archeologiche alla morfologia del terreno; per un'efficace presentazione dei risultati delle ricerche si sono anche 'vestiti' i DEM con le immagini satellitari e vi sono state georeferenziate le evidenze antiche individuate.

Accanto alle immagini satellitari recenti, sono state recuperate anche riprese effettuate prima delle trasformazioni che hanno interessato *Hierapolis* negli ultimi decenni, in particolare la costruzione dalla fine degli anni '60 di quattro alberghi (oggi demoliti) all'interno dell'area archeologica (con la conseguente distruzione di parte del deposito archeologico), la realizzazione di due nuovi accessi monumentali alla città da nord e da sud (inseriti all'interno delle necropoli), l'artificiale ampliamento a fini turistici delle aree coperte dalle formazioni calcaree (a discapito dei resti della viabilità antica extraurbana) e l'impianto, avvenuto negli anni '70, di aree boschive nei territori subito a nord-est della città, interessati dalla presenza di estese cave antiche di travertino, dai tracciati degli acquedotti che raggiungevano *Hierapolis* e da varie fattorie di epoca romano-imperiale e proto-bizantina. Si è pertanto rivelato di particolare interesse il recupero, presso gli archivi dell'USGS (*United States Geological Survey*), di una stereocoppia acquisita dal satellite Corona KH-4A nel 1968 (risoluzione spaziale 2.70 m). Con lo stesso scopo di acquisire una documentazione diacronica del sito, dati molto

interessanti per la ricostruzione della topografia antica di *Hierapolis* sono stati poi recuperati nella cartografia storica disponibile, in particolare le piante di L. de Laborde (1838), P. Trémaux (1858) e C. Humann (1898).

Nel corso delle ricerche, le immagini satellitari recenti sono state utilizzate non solo in sostituzione ed integrazione delle fotografie aeree, ma, opportunamente corrette nelle loro deformazioni geometriche, anche in integrazione alle cartografie disponibili, come base per il lavoro sul campo: le riprese, infatti, ortorettificate mediante DEM e *Ground Control Points*, sono state utilizzate nel corso delle ricognizioni del 2003–2004, prima che fosse completata la cartografia vettoriale di *Hierapolis* in scala 1:1.000 elaborata dalla Facoltà di Architettura del Politecnico di Torino (Spanò 2007; D’Andria, Scardozi e Spanò 2008: 1–9 e 14–16)⁷. Le immagini sono state inoltre inserite come *layers* raster nel GIS di *Hierapolis* e nel webGIS della città e delle necropoli (D’Andria, Scardozi e Spanò 2008: 149–152), oltre che utilizzate per l’aggiornamento della topografia moderna e per la restituzione delle tracce dell’impianto urbano nella stessa cartografia di *Hierapolis*.

Le ricognizioni di superficie e le applicazioni di telerilevamento da piattaforma aerea e satellitare sono state poi integrate (nel 2007–2008) con prospezioni geofisiche (geomagnetiche, *Ground Penetrating Radar*, tomografia elettrica); queste sono state realizzate in varie aree della città (per una superficie complessiva di c. 6 ettari), caratterizzate da un forte interro di sedimenti alluvionali e colluviali (come l’*Agorà* Nord e la zona della scena del vicino Teatro) o da depositi di calcare spessi fino a 4m (come il settore della città subito a nord dell’*Agorà* Civile e del Santuario di Apollo o quello a nord del Ginnasio, lungo il lato occidentale della *plateia*), generati dalle acque che fuoriescono dalle sorgenti situate al centro della città, lungo la faglia sismica (D’Andria, Scardozi e Spanò 2008: 29–30; Scardozi 2010b).

Principali risultati

Le ricognizioni sistematiche dell’area urbana e delle necropoli hanno permesso di acquisire nuovi dati sulla topografia antica della città e sull’articolazione dell’impianto urbano (Figura 8.1), che è stato possibile datare al momento della fondazione della città, nel corso del III sec. a.C. (Scardozi 2007a; D’Andria, Scardozi e Spanò 2008: 31–47). Ne sono state individuate le caratteristiche generali e le trasformazioni avvenute nel corso delle varie fasi di sviluppo della città fino all’epoca medio-bizantina e se ne è documentata la stretta relazione con la morfologia del terreno; è stato così possibile contestualizzare le varie aree di scavo all’interno della maglia urbana e ricostruire tutta la viabilità di accesso alla città, attraverso le necropoli, perfino in parte anche lungo il margine occidentale della città, oggi coperto dalle formazioni calcaree.

Dopo una prima sintesi delle ricerche, confluita nell’ *Atlante di Hierapolis di Frigia* (D’Andria, Scardozi e Spanò 2008), la carta archeologica digitale

della città è in costante aggiornamento da parte del Laboratorio di Topografia Antica, Archeologia e Telerilevamento dell'IBAM, con il completamento dei rilievi topografici dei complessi situati al di fuori delle aree di scavo e con l'inserimento di nuovi *layers* informativi, come quello, aggiunto nella campagna del 2009, relativo a tutta la rete di canali in calcare che attraversano la città (D'Andria c.s.) e scendono nella sottostante valle del *Lykos* (Figure 8.2, 8.3).

Questi canali, formati da spallette in muratura (spesso con materiali di reimpiego) e dal deposito di calcare delle stesse acque, furono realizzati in epoca ellenistica ed imperiale romana per convogliare l'acqua termale delle sorgenti individuate al centro della città, subito a sud del Santuario di Apollo, sia negli edifici termali, che nei campi sottostanti l'area urbana, come ricordano anche Strabone (XIII, 4, 14) e Vitruvio (VIII, 3); dal pianoro su cui sorge *Hierapolis* essi scendono, fiancheggiando gli assi viari che uscivano dalla città, in direzione nord, attraversando la necropoli, verso ovest, dove raggiungono altezze notevoli, superiori ai 10 m, e verso sud, dove uno dei canali principali correva su un ponte-acquedotto di cui si conserva la spalla meridionale (D'Andria, Scardozzi e Spanò 2008: 147). Successivamente, dopo il terremoto della metà del VII sec. d.C., con il venir meno di un'amministrazione urbana che gestisse questa rete idrica, si verificò un'incontrollata fuoriuscita delle acque ed un proliferare di questi canali, che con percorsi irregolari tra le strade e le rovine dei monumenti si estesero su tutta la parte occidentale della città; in epoca medio-bizantina ed ottomana essi venivano utilizzati per portare acqua, a scopi agricoli, per l'allevamento e per la lavorazione della lana, nei vari punti dell'antica area urbana che continuarono ad essere occupati in modo più o meno stabile (Figura 8.4)⁸. Questa rete di canali, che ha una lunghezza complessiva di c. 25km, è stata completamente rilevata mediante GPS differenziale in modalità cinematica ed attraverso la restituzione di orto-immagini satellitari. Contestualmente, con la stessa metodologia, sono state inoltre rilevate e schedate tutte le evidenze riconducibili alla faglia sismica ed ai terremoti che essa ha generato (Altunel 2000): spaccature negli stessi canali e nelle strutture antiche, depressioni e sprofondamenti della superficie del terreno, nonché sorgenti termali, bacini lacustri ed aree umide che si sono formate a seguito della risalita di acqua attraverso la faglia stessa.



Figura 8.2 Particolare della carta archeologica di Hierapolis relativo alla zona a sud del Santuario di Apollo: sono riportati anche gli specchi d'acqua e le sorgenti (in azzurro), la rete di canali in calcare (in blu) e le evidenze legate alla faglia sismica (in verde) (da D'Andria, Scardozi, Spanò 2008, con aggiornamenti).



Figura 8.3 Canali in calcare: A, il principale nella parte settentrionale della città, lungo la plateia; B, uno di quelli che scende nella valle del Lykos; C, canali minori, tagliati dalla faglia sismica, tra la Chiesa a Pilastri e l'Agorà Civile.

Nel corso delle ricerche di superficie sono stati individuati alcuni importanti complessi monumentali successivamente oggetto di scavi stratigrafici. L'esempio più rilevante è costituito dalla scoperta della strada processionale protobizantina che collegava la città al *Martyrion* di S. Filippo, con l'insieme di strutture ed edifici annessi (Figura 8.5); il complesso, individuato nel 2003 durante le ricognizioni svolte a verifica di alcune anomalie e tracce riscontrate nelle immagini satellitari, è stato successivamente oggetto di indagini stratigrafiche (ancora in corso) che hanno messo in luce la Porta di S. Filippo, aperta nella cinta muraria, un ponte posto subito all'esterno, un edificio termale a pianta ottagonale ed una lunga gradinata che saliva sulla collina dominata dalla grande chiesa costruita in prossimità di quelli che secondo la tradizione sarebbero stati i luoghi del martirio e della tomba dell'apostolo Filippo (D'Andria, Scardozzi e Spanò 2008: 95–97, 105; Caggia c.s.; D'Andria c.s.). Nel 2009, inoltre, le attività di ricognizione, pulizia superficiale e rilievo topografico concentrate nella terrazza posta immediatamente al di sotto del *Martyrion*, in direzione sud, contenuta da muri di terrazzamento (Figura 8.6, B), hanno permesso di individuare numerose strutture murarie affioranti pertinenti alla sistemazione dell'area in epoca proto-bizantina, che saranno oggetto di scavi nelle prossime campagne. In particolare, si è evidenziata la presenza di una grande struttura orientata in senso nord-ovest/sud-est (Figura 8.6, A), lunga quasi 30m e larga c. 6, terminante a sud-est con un'aula absidata, che sembra appartenere ad un complesso più ampio (una Basilica?), sviluppato verso nordest ed accessibile da nord-ovest mediante un ampio portale rivolto verso il *Martyrion* ed il percorso processionale. Nell'area indagata è stata anche individuata una

tomba a camera della prima età imperiale (C127), con prospetto a doppio spiovente, che in età proto-bizantina sembra essere stata oggetto di particolare attenzione; è infatti inglobata in murature che definiscono una sorta di piattaforma costruita al di sopra del monumento, mentre sulla facciata vi sono resti di intonaco e di numerosi fori per appendere oggetti, forse ex-voto (D'Andria c.s.).

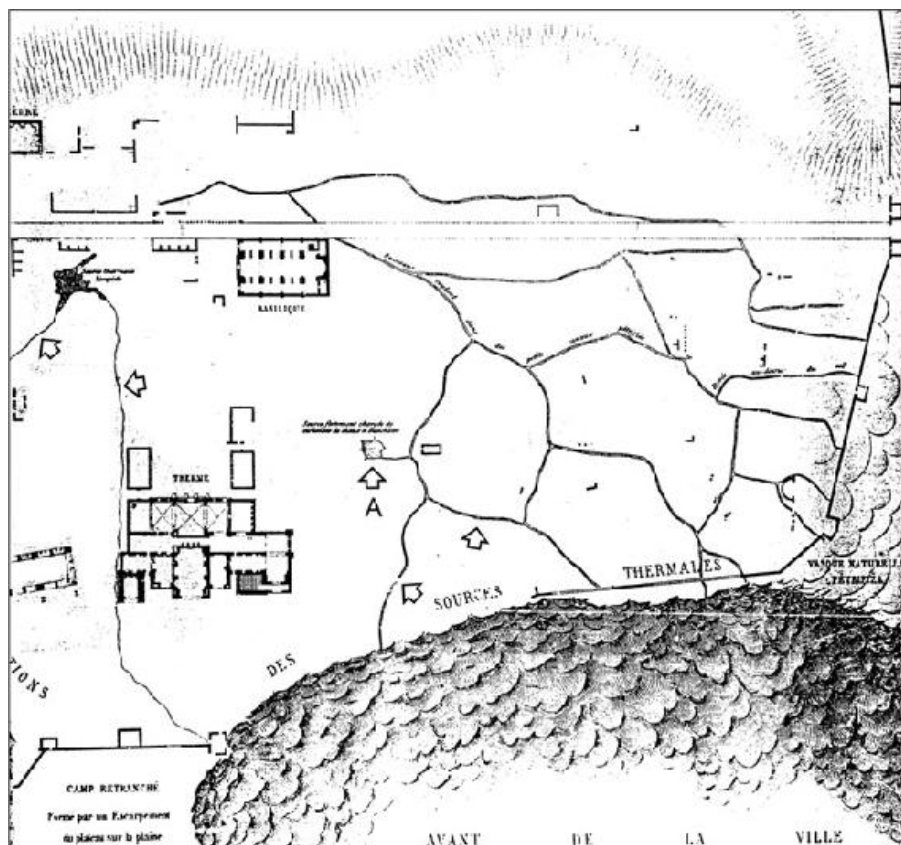


Figura 8.4 Particolare della pianta di Hierapolis di P. Trémaux (1858): sono visibili alcuni canali in calcare ed una sorgente nella parte centro meridionale della città (A) che successivamente sono stati distrutti a seguito della realizzazione di due alberghi.

Tra gli altri complessi monumentali individuati nel corso delle ricognizioni, si ricordano poi la c.d. *Stoà* di Marmo, un portico dorico lungo 62m, realizzato in età giulio-claudia sul lato orientale della *plateia*, subito a sud del Santuario di Apollo (D'Andria, Scardozzi e Spanò 2008: 119), un frantoio di epoca medio-bizantina, situato immediatamente a sud-est del medesimo Santuario (Scardozzi 2010: 285–286), ed un edificio posto nella parte meridionale della città, ad ovest del Ginnasio, caratterizzato da un ambiente centrale con pianta ad omega, nel quale è stato preliminarmente proposto di riconoscere il *Macellum* (D'Andria 2010: 215), menzionato in un'iscrizione di III sec. d.C. dal Santuario di Apollo.

Molto rilevante è stata anche l'individuazione, nel 2008, del c.d. Santuario delle Sorgenti, un grande complesso santuarioale (in corso di scavo) legato alle già ricordate sorgenti di acqua termale poste al centro della città, lungo la faglia sismica, situato subito a sud del Santuario di Apollo, che con il suo peribolo meridionale risulta aperto proprio verso quest'area (Figure 8.2, 8.7, 8.8). Le ricognizioni hanno documentato la presenza di un muro a grandi blocchi di travertino, lungo c. 37m e decorato con elementi architettonici in marmo, anche iscritti, di reimpiego, almeno in parte provenienti dall'*Agorà Nord*, demolita nella seconda metà del IV sec. d.C.; il muro ha un andamento non perfettamente rettilineo in senso nord-ovest/sud-est, forse condizionato dall'andamento del terreno e dalle sottostanti cavità connesse alla faglia, e lungo di esso nel 2009 gli scavi hanno individuato lo sbocco della sorgente, inquadrata da una volta a botte, che alimentava due vasche poste subito ad ovest della struttura e tra le quali si inseriva una *tholos* della prima metà del I sec. d.C. (D'Andria 2010: 218–219; D'Andria c.s.). Da questa sorgente ebbero successivamente origine molti dei canali calcarei che si dirigono verso la parte settentrionale della città, mentre da un'altra sorgente termale individuata poco più a sud nel corso delle ricognizioni, si sono formati molti dei canali che corrono verso la parte centro-occidentale e meridionale della città.



Figura 8.5. Veduta aerea della strada processionale di S. Filippo (2009): A, lo stenopos 13 di epoca romana; B, il raccordo stradale proto-bizantino con la Porta di S. Filippo (C), aperta lungo le mura; D, il ponte; E, le Terme Ottagonali; F, la gradinata; G, la C.D. Torre Selgiuchide, una struttura quadrangolare costruita alla sommità della gradinata, nella terrazza dell'Aghiasma.

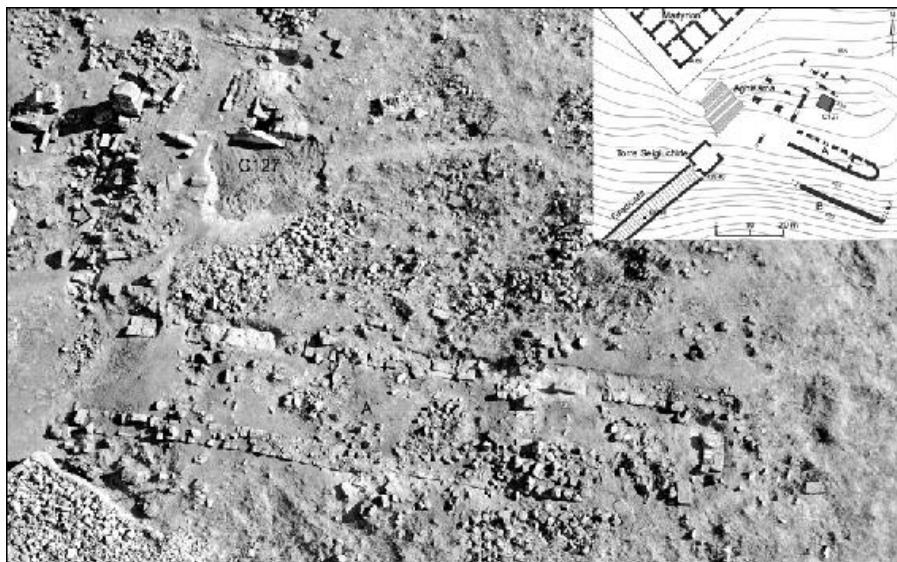


Figura 8.6. Veduta aerea e planimetria generale delle strutture individuate nel 2009 sulla terrazza dell'Aghiasma, subito a sud del Martyrion di S. Filippo: a, possibile navata meridionale di un edificio (una basilica a tre navate?) che inglobava la tomba C127, forse da riferire all'apostolo Filippo



Figura 8.7 Veduta aerea dell'area a sud del Santuario di Apollo (A): sono visibili vari sprofondamenti provocati dalla faglia sismica (B) ed un canale (C) in calcare proveniente dalla sorgente monumentalizzata nel c.d. Santuario delle Sorgenti (D).



Figura 8.8 Veduta aerea in cui è visibile il c.d. Santuario delle Sorgenti (A), raggiungibile dalla plateia grazie ad una strada (indicata dalla freccia) che passava tra la Stoà di Marmo (B) ed un altro portico posto subito più a nord (C); questo passaggio, rimasto in uso anche in epoca medio-bizantina, si trovava probabilmente in asse anche con uno dei principali ingressi all'Agorà Civile, posta subito ad ovest della plateia ed oggi in gran parte coperta dalle strutture del Pamukkale Thermal (D). In alto a destra, la seconda delle principali sorgenti poste al centro della città (E).

Nel corso delle ricognizioni all'interno dell'area urbana sono stati inoltre rinvenuti e recuperati numerosi materiali architettonici, anche iscritti, e sculture in marmo; tra essi si possono ricordare un rilievo ellenistico con scena di caccia dall'area a nord del Teatro (Pellino 2009), un torso femminile molto rovinato pertinente ad una statua di Afrodite dalla parte centro-meridionale della città (D'Andria 2006: 233, fig. 14) ed un grande altare cilindrico di età augustea, riutilizzato nel II sec. d.C. come basamento di una statua di bronzo dedicata ad Atena, rinvenuto seminterrato nell'area a sud del c.d. Santuario delle Sorgenti (D'Andria 2010: 219, fig. 6).

Per alcuni monumenti non considerati dalle precedenti ricerche si è proceduto ad un'indagine sistematica. Il lavoro più impegnativo ha riguardato la cinta muraria, costruita nella seconda metà del IV sec. d.C. e di cui si conservano poco più di 2km del tracciato; tra 2008 e 2009 sono stati realizzati un nuovo rilievo topografico con GPS differenziale ed un *geodatabase* per la documentazione e gestione di tutti i materiali riutilizzati per la sua costruzione e provenienti da altri monumenti di *Hierapolis* che in quegli anni, dopo il terremoto della metà del IV sec. d.C., venivano demoliti: per esempio, molti monumenti funerari delle necropoli, il Teatro e l'Agorà Nord, le due estremità nord e sud della *plateia* e parte del Ginnasio (Castrianni *et al.* 2010; Scardozzi c.s.-b). La gestione dei dati mediante il *geodatabase* consente sia di acquisire informazioni sull'organizzazione e lo sviluppo del grande cantiere della cinta

muraria, sia di apportare nuovi dati sui monumenti che sono stati demoliti per la loro costruzione, particolarmente preziosi quando si tratta di edifici poco noti e di cui si conservano scarsi resti, come il Teatro Nord, oggetto a sua volta di un rilievo sistematico delle poche strutture ancora *in situ* e di prospezioni geofisiche volte a documentare le murature interrato della scena e dell'area tra questa e l'*Agorà* Nord; l'analisi dei resti del Teatro e dei materiali reimpiegati nella cinta muraria (154 sedili in marmo e 176 in travertino) hanno consentito di definirne le caratteristiche tecniche e planimetriche, la cronologia nel II sec. d.C. e vari interventi di restauro e/o di ristrutturazione (Scardozzi c.s.-c).

Conclusioni

Le ricerche di topografia antica svolte a *Hierapolis* di Frigia confermano la necessità e l'importanza dell'integrazione di metodologie di indagine multidisciplinari per la ricostruzione dei paesaggi storici, nello specifico urbani. La ricognizione sistematica ed integrale del territorio oggetto d'indagine, ripetuta in condizioni di visibilità di superficie differenti, si è rivelata lo strumento essenziale per l'acquisizione di nuovi dati sulla struttura urbana della città e delle necropoli circostanti; i metodi di telerilevamento da piattaforma aerea e satellitare (con l'acquisizione di dati di anni successivi ed immagini storiche) hanno poi fornito un contributo fondamentale alle ricerche, in assenza di riprese aeree e, all'inizio delle indagini, di cartografie adeguate al lavoro sul campo. Anche i differenti metodi di prospezione geofisica testati in settori della città con caratteristiche geologiche differenti hanno permesso di ricostruire settori dell'impianto urbano coperti da spessi depositi alluvionali, colluviali e calcarei, nei quali gli altri sistemi di indagine di superficie non consentivano di recuperare dati. Fondamentale, infine, poter disporre, dal 2007, di un supporto cartografico a grande scala, aggiornato ed in formato vettoriale, e poter gestire tutti gli eterogenei dati raccolti e la documentazione disponibile (compresa quella storica) in un sistema GIS.

Va infine evidenziato come a *Hierapolis* gli scavi e le ricerche di topografia antica siano stati anche affiancati da indagini diagnostiche finalizzate allo studio delle cause e delle forme di degrado dei materiali lapidei (in particolare del Teatro), realizzate dai Laboratori di Microscopia Elettronica, Diffattometria a Raggi X e Spettrofotometria FT-IR dell'IBAM (Quarta e Melica 2010); le attività di ricerca sul campo hanno inoltre trovato una valida ed efficace forma di presentazione dei risultati nelle ricostruzioni virtuali di alcuni dei principali monumenti della città (come l'*Agorà* Nord, la Porta e la Via di Frontino, il Ninfeo dei Tritoni, il Teatro ed il *Martyrion* di San Filippo), realizzate dal Laboratorio di Informatica Applicata dell'IBAM⁹.

Notes

1 Il progetto, coordinato da chi scrive ed ancora in corso, è realizzato nell'ambito di una

- collaborazione tra l'IBAMCNR, diretto fino al 2010 dal prof. Francesco D'Andria, ed il Laboratorio di Topografia Antica del Dipartimento di Beni Culturali dell'Università del Salento, diretto dal prof. Marcello Guaitoli, ai quali va il mio sentito ringraziamento per il costante sostegno e per l'interesse con cui seguono le ricerche. Il presente contributo prende in esame le metodologie adottate ed i risultati conseguiti fino alla campagna del 2009.
- 2 Durante le campagne 2005–2008 le attività di ricognizione archeologica sono state estese al territorio della città, al fine di ricostruirne il popolamento antico dall'età preistorica a quella ottomana: le indagini hanno interessato il settore nord-orientale della valle del fiume Çürüksu, l'altopiano di Uzunpınar e la parte occidentale di quello di Çal (è in preparazione un volume di carta archeologica; risultati preliminari delle ricerche sono in Scardozzi 2007b; 2007c; 2010a; c.s.-b).
 - 3 Ciascuna campagna ha avuto la durata di 6-7 settimane tra i mesi di luglio ed agosto. Alle ricerche nell'area urbana di Hierapolis hanno collaborato i dottori Pierpaolo Nardelli (2003), Paolo Ciuchini (2004), Laura Castrianni (2005, 2007–2008), Giacomo Di Giacomo (2007–2009) ed Imma Ditaranto (2008–2009).
 - 4 Le estese necropoli di *Hierapolis* sono disposte a nord-ovest, nord, nord-est, est, sud-est e sud-ovest dell'area urbana, in genere lungo i principali assi viari che uscivano dalla città.
 - 5 Considerando la differente natura delle informazioni ottenibili nelle varie bande, i canali rosso e vicino infrarosso sono risultati i più adatti all'identificazione ed alla definizione delle tracce archeologiche mediate da fenomeni di *stress* della vegetazione, quindi legate alla crescita disomogenea del manto erboso.
 - 6 Per quanto riguarda la stereocoppia Ikonos-2, è stato inoltre possibile realizzare un anaglifo delle immagini epipolari che ha offerto una visione stereoscopica in cui risulta fortemente esaltato il microrilievo ed è possibile misurare differenze di elevazione.
 - 7 La cartografia è realizzata nel sistema di riferimento internazionale (UTM WGS84) adottato anche dalla cartografia turca in scala 1:25000 e 1:100000 (Harita Genel Komutanlığı) impiegata nel corso delle ricerche di topografia antica nel territorio di Hierapolis.
 - 8 Alcuni di questi canali sono stati anche indagati stratigraficamente e ne sono stati recuperati dati di cronologia relativa ed assoluta.
 - 9 Per la metodologia utilizzata vedi Gabellone 2010a; 2010b; per un'esemplificazione di queste ricostruzioni virtuali vedi Limoncelli 2009 e Caggia e Ismaelli 2009.

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The Integrated Urban Survey at *Sagalassos*

F. Martens, B. Mušič, J. Poblome and M. Waelkens

Introduction

Sagalassos is located *c.* 110km north of Antalya. Since 1990 the town and its territory (*c.* 1200km²) have been investigated as part of an interdisciplinary research project of the Katholieke Universiteit Leuven (Belgium) directed by M. Waelkens (Waelkens 2004; 2006). After a first decade of large-scale excavations mainly within the monumental centre, an integrated research strategy was devised and applied to obtain a better insight into the development of the town plan (Figure 9.1) and the chronological evolution and functional organization of the urban area. This research comprised a programme of test soundings on the network of streets (1998–2008: Martens 2007; 2008) and an architectural and intensive surface survey covering over two-thirds (23.43ha) (Figure 9.2) of the inhabited urban area (*c.* 31.5ha) within the sepulchral zones (1999–2005: Martens 2005; Martens *et al.* 2008). The results of this work could be combined with the evidence generated by other non-invasive techniques including geophysical survey (since 2002), supervised by Branko Mušič (2008; Mušič *et al.* 2009).

State of the art

For a long time archaeological survey in Turkey was largely confined to single-period or architectural-epigraphic survey projects (Alcock 1994: 181). This situation has been changing fast during the last decade (Yıldırım and Gates 2007: 277), as is also testified by the growing number of survey projects represented in the yearly conference proceedings of non-invasive archaeological research in Turkey (*Araştırma Sonuçları Toplantısı*). Although the number of multi-method urban surveys still remains limited, ongoing projects on major sites (Ephesos: Groh *et al.* 2006: 48, n. 10; Troia: Jablonka 2006: 6–7) are conducting intensive surface collections, combined with geophysical survey. In addition, site based topographical/architectural surveys are increasingly incorporating these survey techniques as well, as in the case of the ‘Pisidia Project’ (e.g. Vandeput and Köse 2004; Vandeput *et al.* 2005). Modern research at *Sagalassos* was initiated within the framework of the

‘Pisidia Project’ (1985–1989: Mitchell 1998, with references; Waelkens 2006: 325–326). Meanwhile, large-scale excavations and the interdisciplinary investigation of town and territory (Waelkens 2008) have made *Sagalassos* one of the better documented sites of Pisidia. The urban research allowed reconstructing the building history of *Sagalassos* from the Hellenistic period¹ into the seventh century AD, whereby a devastating earthquake, occurring between 600 and 620AD (De Cupere *et al.* 2009), further enhanced the decline, which had already set in during the second half of the sixth century AD.

As opposed to earlier assumptions, however, the site continued to be inhabited by small-scale communities at least into the thirteenth century AD (Vionis *et al.* 2009: 193). For the town’s *chora* the occupation pattern was first explored with a reconnaissance survey (1993–1998) (Vanhaverbeke and Waelkens 2003), forming the basis for an intensive survey (1999–2006) by H. Vanhaverbeke applying a stratified sampling strategy in the primary catchment area of the settlement within a *c.* 5km radius (one hour walking from the town across flat terrain) (Vanhaverbeke in Martens *et al.* 2008). Simultaneously with the hinterland survey, in 1999 also the urban survey was initiated. As there was no comparable work in Turkey at this time, the initial research design followed the example of the Boeotia survey (Bintliff and Snodgrass 1985). However, the unploughed character of *Sagalassos*, the low finds density and the steeply sloping terrain conditions presented major methodological challenges.

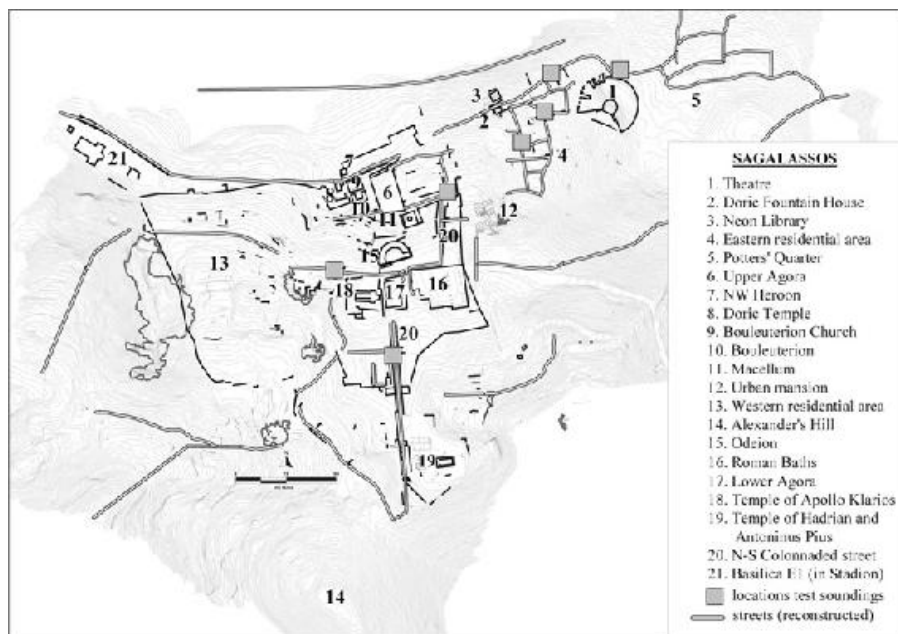


Figure 9.1 The urban plan of Sagalassos with the street system as reconstructed on the basis of excavations and geophysical survey (F. Martens; B. Mušič).

For the application at *Sagalassos* of high resolution shallow geophysics, the challenges were posed by the diverse archaeological contexts of different origin and preservation, the alternating geomorphological units with natural or man-made obstacles at the surface and the diverse top soil compositions of varying depths and lithologically variable underlying bedrock. As it was difficult to classify the *signal to noise ratio* for each geophysical technique for such diverse or unpredictable subsurface conditions, a multi-method approach was designed using various complementary geophysical methods, as tested at *Tanagra* (Boeotia) (Bintliff *et al.* 2000; 22001; Mušič *et al.* 2004; 2005) or *Trea* (Potenza Valley) (Vermeulen *et al.* 2009: 85–110). In addition, the approach of other surveys in comparable conditions was consulted to resolve specific tasks and special attention was paid to certain algorithms used in the processing flow for enhancing the *signal to noise ratio*.

Methodology

The intensive archaeological survey

Field conditions at *Sagalassos* differed from many other archaeologically surveyed Mediterranean sites in the sense that the town was laid out on sloping terrain, which had not been intensively cultivated after the end of the large-scale occupation. This had consequences for the distribution of the surface material. The absence of a regular turnover of artefacts in the soil implied that a chronological superposition of archaeological evidence was to be expected, whereby the last phase of the large-scale occupation prevailed in the surface record (Figure 9.2), unless when disturbed by post-depositional processes. This situation, together with the fact that the average pottery densities proved to be rather low (0.2 sherds per m²) with a small amount of diagnostic sherds (0.03 per m²)² especially in comparison to the rates seen in many Mediterranean surveys, urged us to try and control or assess as much as possible the impact of biases either related to the survey procedure or caused by the field conditions (Martens *et al.* 2008).

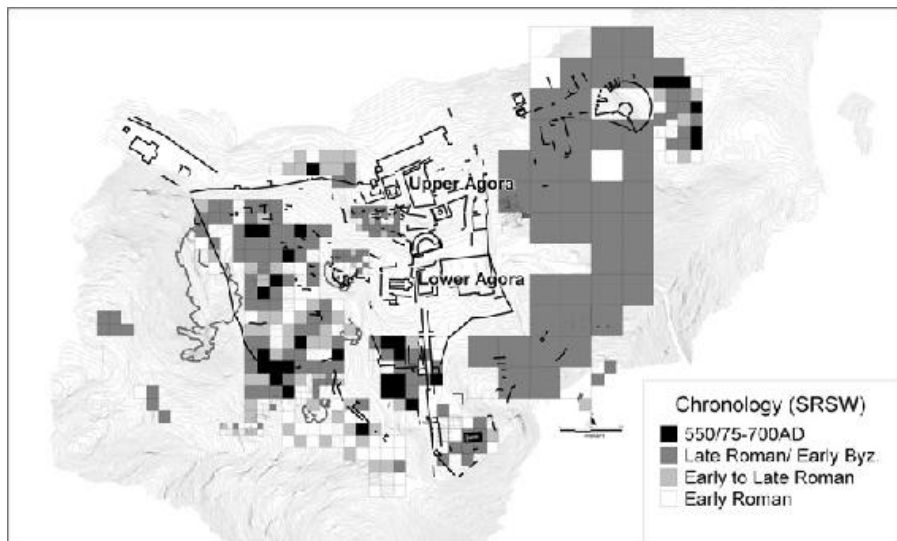


Figure 9.2 The chronological distribution of the surface finds, showing the youngest prevalent period per surveyed square (F. Martens).

Firstly, with regard to the field strategy, the intensity of the coverage, the size of the grids and the choice of the collected material were important. The field strategy evolved from a sampling strategy (1999) based on 50×50 m squares, providing a reliable yet insufficiently differentiated research result, over a too intensive and thus slowly progressing full coverage strategy in grids of 10×10 m (2000), to result in an intensive coverage of squares of 20×20 m with a walker distance of 2m, which ultimately proved to be both time-efficient and most likely to produce a representative data-set (Martens 2005: 235–240: figs 3, 5).

To calibrate the density counts and to compensate for the level of ground cover the degree of surface visibility was assessed using five classes with increasing visibility. Objections have been formulated against using visibility rates to produce visibility corrected pottery distribution maps (Lock *et al.* 1999: 59–60; Meyer and Schon 2003: 52–57; Thompson 2004). One of the arguments is that the empirical data of the density count are multiplied with a factor generated on the basis of a subjective visibility allocation (Mattingly 2000: 12). Yet, provided that the raw data are presented as well and that ‘corrected figures’ are marked as such, visibility correction can be justified. By using five instead of ten classes (as in the Boeotia survey), the visibility categories could be linked to clearly described field conditions (involving specific constellations and vegetation species) which were thus more likely to be assessed in the same manner by all field walkers. To increase the reliability of the surface collection all material – diagnostic as well as non-diagnostic – was counted and collected, except for building ceramics which were counted in the field. Surface architecture was measured and mapped on a scale 1:200. Two teams of five persons surveyed simultaneously and to improve the

consistency of the procedure meters were laid out along each grid. As such the person registering the density counts and visibility assessments could ensure that equal ranges were covered per step. Prior to the survey, team members were introduced to the material at the project's find depots and in the field it was checked regularly whether they used the same standards for density counts and visibility assessments.

A second and even more important bias for the surface survey comprised site formation processes and post-depositional disturbance. The monumental centre of *Sagalassos* was laid out on a complex of extended limestone platforms, whereby the homogeneous debris slope with grasses and low shrubs of the Eastern Residential Area contrasted strongly with the terraced western domestic (Martens 2005: 234, fig. 4), artisanal and sepulchral zones with more rugged vegetation. Geomorphological research suggested that these sloping terrain features combined with other physical agents (local absence of vegetation, heavy rainfall causing surface run off, animal trampling) exposed the archaeological record to significant post-depositional disturbance (Paulissen *et al.* 1993; Martens *et al.* 2008: 131, with further references). This was exemplified by a comparison of the surface-subsurface conditions. In the Eastern Residential Area, surveyed with the 1999 sampling strategy, test soundings 'TSW1' and 'TSW2' were excavated (Figure 9.1: 4; Martens 2007: 324, fig. 2: 7). In these trenches either through man-induced or natural erosive processes – possibly after the decay of certain retaining structures – exclusively early Imperial contexts were excavated, which were not represented in the surface record here, where as an overall result the late antique period prevailed (Martens *et al.* 2008: 132). At the western edge of the same residential zone also trench 'TSW5' testified severe (local?) surface erosion (Martens 2007: 324, fig. 2: 11; 352–353). Elsewhere in the Eastern Residential Area the chronology of the excavated levels did reappear in the surface material, but not necessarily in a quantitatively proportional relationship.³ The 1999 sampling strategy, in general, proved to be less well suited to record ill-represented periods or non-ceramic material categories. As opposed to the eastern part of the site, early to middle Imperial sherds did appear in high densities ('chronological windows') in the western part of the site, especially at those locations where severe erosive processes affected sparsely vegetated slopes (Martens 2005: 246–248; Martens *et al.* 2008: 136–137).

The geophysical survey

(B. Mušič)

As for surface collection, also for geophysics there is no 'cook-book strategy'. In compliance with the field conditions of each zone, various geophysical techniques were applied at *Sagalassos*, building upon preceding results and with feedback offered by evidence from the excavations. Initially a testing polygon (c. 1ha) was selected within the Eastern Residential Area, whereby

the reliability of the results could be verified using the data from the test soundings (Martens 2007). In the period 2002–2010, an area of over 12ha was surveyed at the eastern half of the site using the magnetic method, of which 37 regions (c. 3.6ha) were re-surveyed by closely spaced parallel GPR profiles (Figure 9.3). The resistivity and conductivity methods were applied to a lesser extent at the Eastern Residential Area and Potters' Quarter. These procedures will be outlined below.

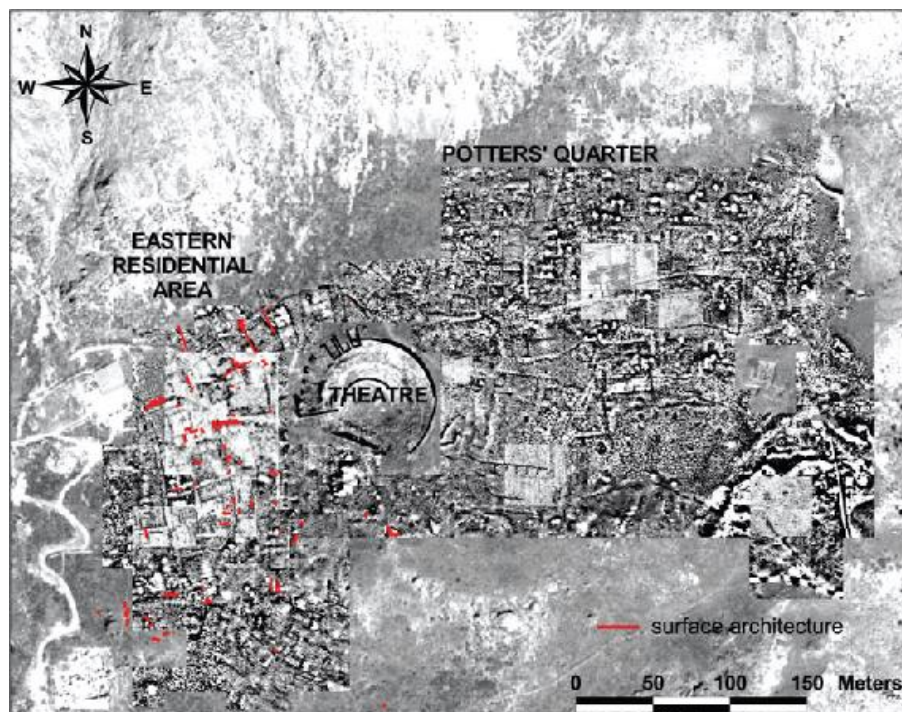


Figure 9.3 Selected GPR time slices and mapped surface architecture on the magnetometry map of the Eastern Residential Area and Potters' Quarter (B. Mušič; F. Martens) (Satellite image: © 2003: Digital Globe. All rights reserved. 19.09.2003 at 8.30 AM).

In the earliest stages, the field work comprised a *magnetic survey* measuring the vertical gradient of the earth's magnetic field by means of a Fluxgate gradiometer Geoscan FM36 in addition to resistivity mapping with a resistance meter Geoscan RM15 in a twin probes configuration. Considering the rough terrain conditions, the choice of a light-weight easily portable magnetometer was self-evident. The measurements in grids of $0.5 \times 0.5\text{m}$, however, were not entirely satisfactory due to the lower resolution of the fluxgate sensors in comparison to the optically pumped caesium sensors. Moreover, for the resistivity mapping the high-resistivity contact was hindered by the surface debris and the dryness of the topsoil. 2D resistivity sections across the Eastern Residential Area (Similox-Tohon *et al.* 2004: 1–18), however, suggested the presence of well-preserved archaeological structures (c. $2.5 \times 5\text{m}$) (see also Mušič *et al.* 2009).

Consequently, a total field magnetometer Geometrics G-858 in gradient mode was introduced, which generally amplifies the weak magnetic anomalies of small structures at shallow depths in favour of long-wave anomalies caused by the geological background. This magnetometer also allowed observing magnetic field readings separately on the top and the bottom sensors, so that a single sensor resolution approach, a more refined method for specific archaeological contexts (e.g. potters' workshops), could be tested (Tabbagh 2003: 75–81; Mušič 2008: 60: fig. 13). The Geometrics G-858 attained a resolution of 0.1–0.2 nT/m in measuring the total magnetic field density with an acquisition at a rate of 5Hz along the 0.5m spaced transects. The readings were interpolated to a sample interval of 0.25m using the cubic 'spline approximation to the sinc function'.

The magnetic method especially produced excellent results for the northeastern part of the town. Measurements of the apparent magnetic susceptibility of samples of top soil, excavated levels or drillings revealed extremely high susceptibility values at the Eastern Residential Area and Potters' Quarter (see Mušič 2008, 54: fig. 3). Aside of the thermoremanent magnetization, also the significant differences between the susceptibility of the (limestone) building materials and the surrounding soil,⁴ induced a clear representation of the archaeological remains (Figure 9.3). Besides of the anthropogenic agents, the observed differences in magnetic susceptibility of the topsoil were also determined by the complex geology of the site (see Similox-Tohon *et al.* 2004: 1–18). The magnetic method picked up the induced magnetization typical for stone built walls (in the Eastern Residential Area) and the strong thermoremanent magnetization of clay-built structures (e.g. kilns in the Potters' Quarter). In the data processing some less common approaches were used to amplify the *signal-to-noise* ratio. Due to the bipolar nature of the geomagnetic field, magnetic anomalies located elsewhere than at the magnetic poles are asymmetric even when the magnetic source distribution is symmetrical. In general, the RTP transformation (see Telford *et al.* 1990) significantly reduces the complexity of the distinctive bipolarity of induced and thermoremanent magnetic anomalies, which is characteristic for the latitude of *Sagalassos*. As such, e.g. walls detected close to each other could still be accurately discerned (Mušič 2008: 55, fig. 4; 57, fig. 8). The *Sagalassos* results demonstrated that this transformation was also useful for objects with thermoremanent magnetization (kilns; furnaces; forges) (Mušič in Uytterhoeven *et al.* 2010: 303, fig. 3).

For interpreting the results all-encompassing 2D archaeophysical magnetic models were convenient (e.g.: Mušič and Orengo 1998: 157–186, Mušič and Horvat 2007: 219–283, Mušič 2008: 58, fig. 10), which were generated by comparing on-site measured values of the total magnetic field density with the calculated magnetic anomalies for the presumed archaeophysical model. Such model's variables comprise the shape, dimensions and depth of the presumed remains and the magnetic susceptibility values of the

building material.

Finally, a better recognition of anomalies was obtained by determining the deeper magnetic sources with a significant background noise reduction using the upward continuation (Mušič 2008: 57, fig. 7). The values of the potential earth's magnetic *field* can be calculated using measurements of the magnetic *field* at a certain level above the modern surface. Residual magnetic anomalies are obtained by subtracting the upward continuation field from the initial on-field observation. The residual magnetic field is opposed to the upward continuation, which is normally used for the recognition of high frequency magnetic disturbances from sources close to the surface (Yaoguo and Oldenburg 1998: 431–439). At *Sagalassos* higher residuals corresponded to areas diffusely polluted by strongly magnetic iron minerals (blacksmiths' and/or potters' activities?) (Mušič 2008: 58, fig. 9).

In a later stage of the geophysical survey at *Sagalassos Ground Penetrating Radar* (GPR) sounding was introduced. This technique, using 200, 400 and 500 MHz antennas (*GSSI SIR3000*), was applied on the instigation of the magnetometry results to resolve research questions concerning the reconstruction of the water network (preservation issues) and the street system (presence or absence of pavement) or the analysis of complex building remains. The quantitative data required for a 3D display of the architectural remains was obtained through an analysis of individual GPR echoes. While the width of the walls was deduced by applying migrations and Hilbert's transformations, the preserved depths were determined using the 'hyperbola adaptation method' (Conyers and Lucius 1996: 25–38). However, the propagation velocity of the electromagnetic waves altered throughout the site due to the subsurface composition and soil moisture.

The GPR results confirmed the suitability of the more robust 200 MHz antenna, rather than the 400 MHz antenna, which was better-suited for surveying shallow archaeological targets. The upper and lower limits of a horizontal reflector (e.g. a paved street surface), was visible on the radargram if its width exceeded one quarter of the wavelength. At the estimated dielectric permittivity (10–12) of the soil of the northeastern part of the town the wavelength of the 200 MHz antenna measured *c.* 0.5m, implying that horizontal layers (paved areas) thicker than 0.1m were reliably discerned on the radargrams. For representing the GPR results the 'time slices method' was used showing a series of parallel, usually equally spaced profiles (Figure 9.3) (e.g. Goodman *et al.* 1995, Mušič in Uytterhoeven *et al.* 2010: 304, fig. 4), in addition to 3D visualizations (Mušič 2008: 61, fig. 15; Mušič in Uytterhoeven *et al.* 2010: 304, fig. 5).

Based on the results of the magnetic prospection at *Sagalassos*, as a last technique, the *electric conductivity* method using electromagnetic induction (Geonics EM38) was tested. Measurements were carried out in 'step mode' with a 0.5m interval using the instrument's highest sensitivity (depth: 1m). As anticipated in these extremely dry soil conditions the results were somewhat

better in areas with quick lateral changes in the top soil susceptibility, but generally this method was less suited for *Sagalassos*.

Results

The integrated research strategy applied at *Sagalassos* contributed to various research questions concerning the organization and chronological development of the urban area (for a detailed overview see Martens 2005: 242–249, figs. 7, 11, 12; Martens *et al.* 2008: 135–139; Martens in prep.). As a general chronological result, the large-scale occupation of the urban area, which based on the excavated evidence seems to have experienced a swift expansion beyond the Hellenistic wall circuit from early Imperial times onwards, proved to have continued into the sixth century AD (Figure 9.2), with a less extensive (and less dense?) occupation during the later sixth and into the seventh century AD.

A re-study (2007–2009) of all of the collected pottery including also the non-diagnostic sherds⁵, allowed identifying scatters of formerly ill-known Classical/Hellenistic and early medieval to mid Byzantine sherds throughout the urban area, thus filling in gaps in the settlement history of *Sagalassos* and offering better grounds to study the significance of the town within the region during these periods. Remarkably high densities of Classical/Hellenistic pottery on the erosive slopes in the artisanal-sepulchral zone southwest of the walled circuit refer to an active exploration of this area during this period, the nature of which remains to be further investigated.

At the other end of the chronological balance, surface pottery from the promontory of the former sanctuary of Hadrian and Antoninus Pius (Figure 9.1: 19) proved to correspond with the occupation of this fortified refuge from the later seventh–eighth century onwards and in middle Byzantine times, as was revealed by excavations here (Vionis *et al.* 2009: 192, 200).

With regard to the spatial organization of the town the analyses of find categories other than pottery (including surface architecture), combined with the results of geophysics and test soundings, allowed determining a basic functional zoning, whereby the monumental centre proved to be flanked to the east and west by residential zones including a variety of urban functions (see Martens 2005: 242–245; Martens in Uytterhoeven *et al.* 2010). Artisanal zones were excluded from these domestic areas and concentrated in the southwestern and eastern periphery of the site, close to or intermingled with the sepulchral zones surrounding the town. Whereas in the area of the Potters' Quarter, which was not covered by the archaeological survey, kilns and workshop infrastructure could be identified through geophysics (Figure 9.4; Mušič *et al.* 2009: fig. 9, 10, 13) and excavations (Murphy and Poblome 2011), in the southwestern artisanal zone metal working was identified through geochemical analyses (Kellens *et al.* 2003: 551–552).⁶

As for the urban planning of *Sagalassos*, on these steep terrain conditions

a technologically sound principle of practical planning proved to be applied. In the Eastern Residential Area e.g., groups of *insulae* – which from early Imperial times onward were supplied with running water – were divided by 2–3.50m wide streets (Figures 9.4, 9.5), which were only partly accessible to wheeled traffic. These *insulae* showed different orientations, either following the cardinal directions or determined by the direction of the slope. After a major phase of urban layout during the first half of the first century AD at least one major building phase followed during the second–third century AD, whereas certain plots were no longer in use in late antique times (Martens 2008; for a detailed description, see Martens in Uytterhoeven *et al.* 2010, 289–307). Particular methodological challenges for geophysics concerning the possibility to distinguish paved street surfaces from dismantled streets or to identify and trace well-preserved stone or brick-built water channels, remained problematic unless reference could be made to nearby excavations.

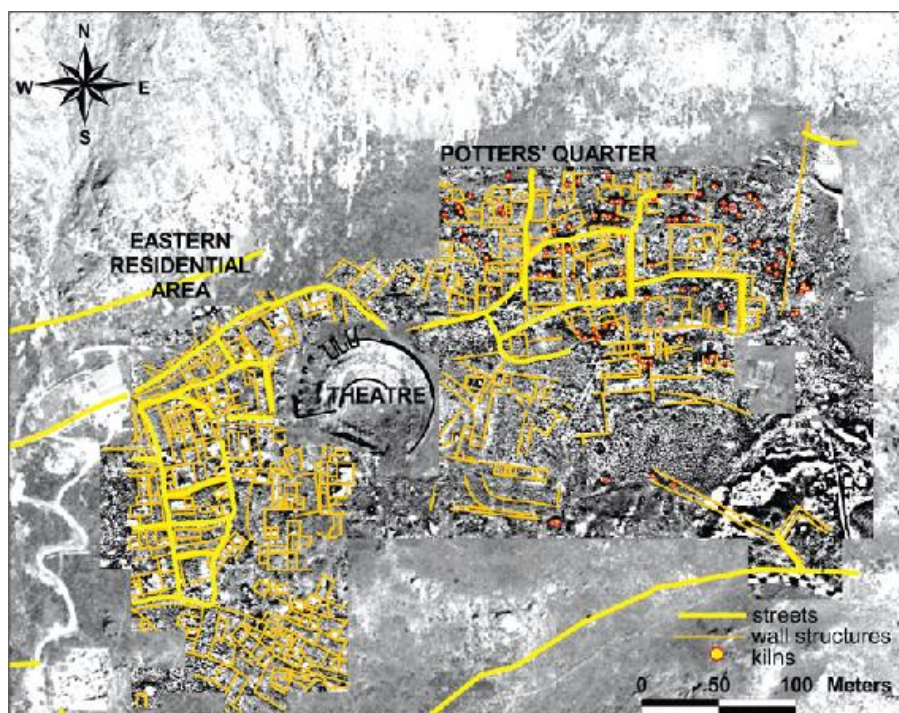


Figure 9.4 Interpretation of the results of geophysics at the Eastern Residential Area and Potters' Quarter (B. Mušič) (Satellite image: © 2003: Digital Globe. All rights reserved. 19.09.2003 at 8.30 AM).

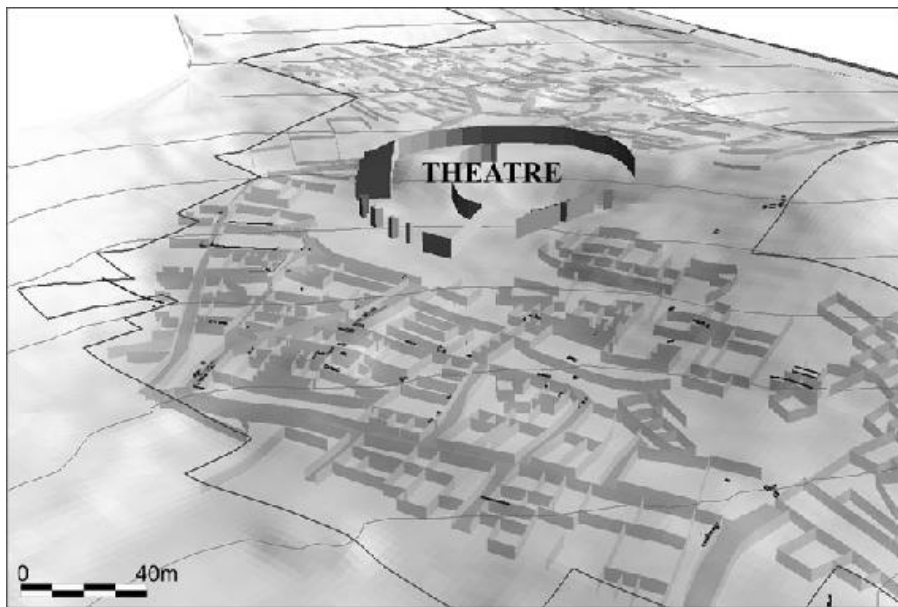


Figure 9.5 3D view of the north-eastern part of Sagalassos from the southwest, demonstrating the integral interpretation of the results of the multi-method geophysical approach (B. Mušič).

Conclusions

This paper illustrated how, both for the archaeological as well as for the geophysical survey, devising an appropriate site-specific strategy was a process of trial-and-error. A number of issues could be remedied by an improved research design or had to be born in mind as a restriction for the interpretation of the research results. For the archaeological survey the diversified terrain conditions with a differential impact of post-depositional processes implied that a more intensive survey strategy had to be applied to increase the reliability of the results. The fact that all surface finds were collected allowed a re-study of the sherds, as pottery research evolved. For the investigation of the historical evolution of the urban area the chronological superposition of pottery on the uncultivated terrain nevertheless implied that the absolute number of sherds could not be used to simply measure changes in site size or occupation intensity.

In addition to a clear insight into the functional zoning of the urban area, the archaeological survey thus offered a spatial view on general chronological trends for which the outlines had been offered by the results of epigraphical research, architectural studies and excavations in the monumental centre. For the particular situation of *Sagalassos*, the collected surface evidence on its own would not have been unequivocal enough to offer these insights independently. By combining the survey results with other research data (surface architecture, results from geophysical survey, test-soundings, large-

scale excavations) the quality and restrictions of the surface evidence could be better assessed, while obviously the reliability of the obtained overall picture increased significantly by this integrated approach targeting the entire urban area.

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Notes

- 1 The relationship between *Sagalassos* and the in 2005 discovered Classical/Hellenistic site at 'Düzen Tepe' 1.8km southwest of *Sagalassos*, occupied from the c. fifth until the second century BC, is still under investigation (Vanhaverbeke *et al.* 2010, Waelkens *et al.* submitted).
- 2 These averages are calculated on the basis of the pottery evidence from 238 grids of 20m² (2001–2005).
- 3 The relationship between evidence from survey and excavations is further discussed in Martens in prep.
- 4 For instance, the mean top soil susceptibility values for the Eastern Residential Area (4.53×10^{-3} SI) and northern and western parts of the Potters' Quarter (5.48×10^{-3} SI) are comparable. Extremely high top soil susceptibility results mainly from the large quantities of pottery dust mixed in the top soil. The mean susceptibility value of kilns excavated at the Potters' Quarter in 2004 is 19.86×10^{-3} SI. The lower average susceptibility at the eastern part of Potters' Quarter (2.75×10^{-3} SI) refers to the lower top soil susceptibilities upon the ophiolitic melange.
- 5 Whereas the initial analyses were based solely on diagnostic table wares (*Sagalassos* Red Slip Ware), the new approach developed by J. Poblome and applied by the pottery team (N. Firat and others) included all sherds, taking into account various functional categories and full typological date ranges (for a first approach, see Poblome *et al.* in Bintliff *et al.* 2004: 561–569). Upon this new dataset various data distribution techniques were applied by R. Willet. The results offer a better view on the representation of various chronological periods, but the functional analysis of the pottery now also allows an assesment of the composition or quality of the 'assemblages'. Hereby, a general preponderance of pottery types used for consumption and serving as opposed to a minority of cooking and other wares (transport, storage, preparation) was noticed for the early and middle Imperial periods, whereas only the late antique material seemed to comprise viable functional (domestic) 'surface assemblages'. These issues, whether influenced by terrain conditions, the impact of the local potters' industry (SRSW) or other contributing factors, are now further investigated in collaboration with J. Poblome and R. Willet (Martens in prep.).
- 6 Waste products of local metal working or pottery production were commonly used respectively for road metalling or construction activities (levelling, terracing). Geochemical analyses of soil samples from areas with concentrations of metal slag allow a more secure functional interpretation. For references on the research on pottery production, metal working and secondary glass working at *Sagalassos*, see Waelkens 2008: 10–11.

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Progetto ‘*Ager Aquinas*’. Indagini aerotopografiche finalizzate allo studio della città romana di *Aquinum* (Lazio, Italia)

G. Ceraudo

Introduzione

Il Progetto ‘*Ager Aquinas*’ si inserisce tra le attività del Laboratorio di Topografia Antica e Fotogrammetria presso il Dipartimento di Beni Culturali dell’Università del Salento a Lecce: ricerca avviata nel 1998 con lo scopo di sviluppare, attraverso un esempio applicativo di largo respiro, un modello operativo finalizzato all’individuazione dei beni archeologici nel territorio, alla loro conoscenza, catalogazione ed interpretazione, in un Sistema Informativo Territoriale volto alla gestione e alla diffusione dei dati¹.

Il progetto interessa il territorio appartenuto alla colonia triumvirale di *Aquinum*; oggi nel Lazio meridionale, nella media valle del Liri al centro della vasta pianura dominata dal massiccio del Monte Cairo a Nord e dalla catena degli Aurunci a Sud, sul ciglio occidentale di tre antichi laghi oggi scomparsi². Lo studio viene condotto seguendo il patrimonio di esperienze della Topografia antica, metodologicamente e tecnicamente aggiornate³.

L’attività sul campo e di laboratorio, è stata condotta seguendo quelle linee di ricerca che da sempre caratterizzano la ricerca topografica del gruppo di ricerca leccese (Figura 10.1): esplorazione archeologica del territorio mediante ricognizione diretta sistematica, fotogrammetria finalizzata all’archeologia, uso e applicazioni specialistiche della fotografia aerea verticale ed obliqua, ricognizione aerea a bassa quota, rilievo e analisi dei monumenti, prospezioni geofisiche e organizzazione di una banca dati collegata alla cartografia e agganciata al Sistema Informativo Territoriale sviluppato all’interno del LabTAF⁴. Recentissime indagini di scavo archeologico condotte nel biennio 2009–2010, di verifica ed in coordinata prosecuzione con le attività di ricerca sopra citate, hanno interessato un settore centrale all’interno dell’area urbana⁵.

Stato dell’arte

Nonostante alcuni importanti lavori di carattere topografico eseguiti in momenti diversi del secolo scorso dal Cagiano de Azevedo⁶ e dal Giuliani⁷, *Aquinum* mancava di una adeguata cartografia per la redazione della carta archeologica di dettaglio. Della città romana esistevano soltanto schemi ricostruttivi della forma dell'abitato e della sua articolazione stradale interna, che avevano permesso di delineare in maniera alquanto schematica i principali aspetti della topografia urbana (Figura 10.2).

Metodologia

Ricognizione topografica

Con l'intento di rinnovare tale filone di ricerca, pur senza perdere di vista gli obiettivi fondamentali di conoscenza da raggiungere attraverso l'indagine topografica sul territorio, va ribadito che questo tipo di attività viene necessariamente supportato dalle consolidate tecniche di ricognizione diretta sul terreno: integrale e sistematica. Ai risultati delle ricognizioni sono stati applicati nuovi metodi di registrazione anche cartografica, delle presenze e della distribuzione delle testimonianze archeologiche, tenendo conto anche delle assenze e dei fattori geografico-ambientali che possono aver influenzato, condizionato, limitato o impedito la lettura diretta sul terreno, descrivendone il grado di leggibilità in carte delle 'visibilità' del terreno ricognito. Inoltre, per agevolare le operazioni di schedatura sul terreno, è attualmente in corso di implementazione e sperimentazione un nuovo software di supporto alla ricognizione topografica – denominato Progetto Ulixes – concepito per girare su sistemi compatti (PC palmari e tablet PC). Il sistema comprende al suo interno un modulo per l'acquisizione delle schede di Unità Topografica che associa automaticamente la posizione del rinvenimento alla sua descrizione (di Giacomo e Scardozzi 2008).



Figura 10.1 Attività sul campo e di laboratorio condotte nell'ambito del Progetto 'Ager Aquinas' – LabTAF, Università del Salento.

Fotogrammetria finalizzata e fotointerpretazione archeologica

Il Laboratorio di 'Topografia antica e fotogrammetria' dell'Università del Salento è uno dei centri operativi esistenti in Italia per la cartografia finalizzata all'archeologia, impostato per rispondere alle necessità di acquisizione di criteri metodologici e di tecnologie moderne da applicare alla conoscenza e alla catalogazione dei beni esistenti sul territorio e per produrre basi cartografiche (realizzate in prima persona da operatori archeologi) sviluppate al massimo livello tecnologico attuale, supporto ideale per la redazione di Carte Archeologiche (da Ceraudo 1999).

Nonostante alcuni importanti lavori di carattere topografico eseguiti in momenti diversi del secolo scorso dal Cagianò de Azevedo (1949) e dal Giuliani (1964), *Aquinum* mancava di una adeguata cartografia per la redazione della carta archeologica di dettaglio. Della città romana esistevano soltanto schemi ricostruttivi della forma dell'abitato e della sua articolazione stradale interna, che avevano permesso di delineare in maniera alquanto

schematica i principali aspetti della topografia urbana (Figura 10.2).

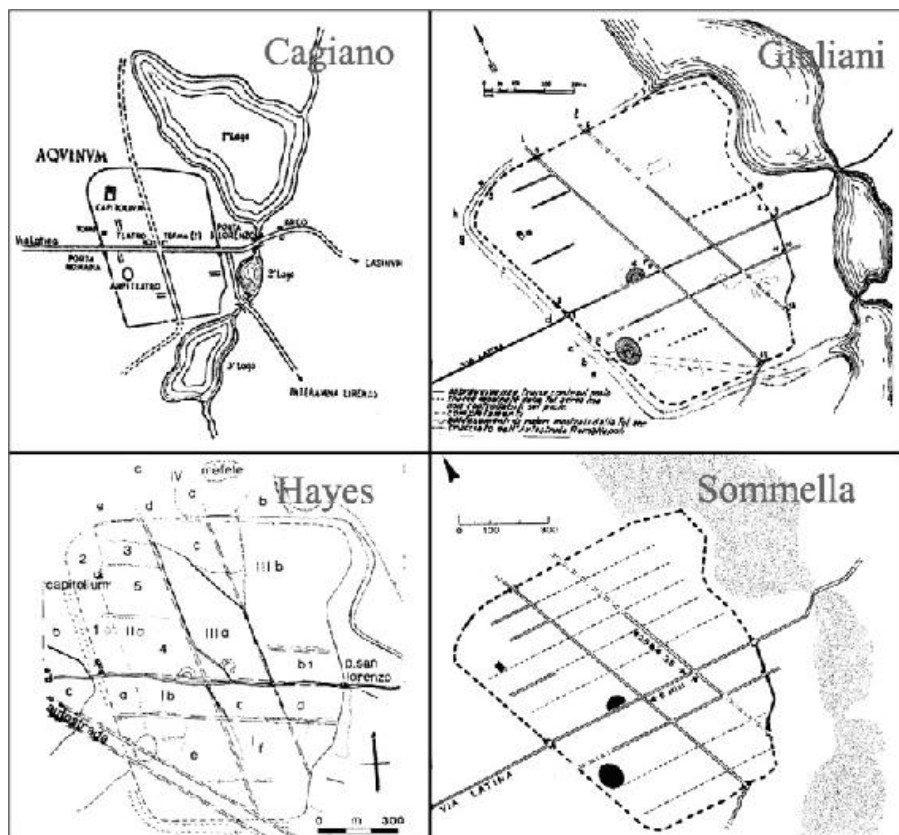


Figura 10.2 Planimetrie schematiche di Aquinum precedenti l'inizio delle attività di ricerca del labTAF desunte da Cagiano de Azevedo (1949), Giuliani (1964), Hayes (1994) e Sommella (1989).

Proprio perché non esisteva una cartografia adatta al tipo di intervento in atto, è stata appositamente realizzata presso il LabTAF la restituzione aerofotogrammetrica numerica a scala 1:2000 dell'area urbana e sub-urbana della città antica (Figura 10.3). La restituzione aerofotogrammetrica, integrata con l'indagine sul campo, ha permesso di avanzare dei dubbi e di formulare alcune ipotesi che, prontamente verificate sul terreno, hanno consentito di delineare in maniera più particolareggiata la forma della città, in particolar modo per il settore orientale. E' stato così possibile ricostruire un circuito più ampio delle mura, più vicino al ciglio del vallone e più razionale alle esigenze difensive della città. Con questa variazione la superficie dell'abitato risulta ora pari a c. 100 ettari contro gli 85 prima stimati (Cfr. nota 2).

Per quanto riguarda la struttura interna dell'abitato di Aquino, questa è stata ricostruita, sempre sulla base della fotografia aerea e delle poche persistenze visibili sul terreno, dal Giuliani (1964), che individuò il particolare schema regolare ma non ortogonale della colonia triumvirale, con assi che non

si incrociavano ad angolo retto ma davano vita ad isolati a forma di parallelogramma. Oltre all'attività sul terreno, quindi, grande spazio è stato dedicato all'analisi specialistica della fotografia aerea verticale, strumento fondamentale per la conoscenza e la documentazione negli studi di 'topografia archeologica', che con le sue applicazioni rappresenta una delle fonti che ha offerto la maggior quantità di risultati utili per gli studi del settore. Tutte le tracce, opportunamente acquisite, hanno offerto nuovi spunti per lo studio e la comprensione dell'impianto urbano, autorizzando a rivedere e a modificare, non tanto nella forma, quanto nella sostanza, quello che doveva essere il piano programmatico dell'urbanistica aquinate. E' stato possibile ricostruire quella che dovrebbe essere l'articolata struttura dell'impianto urbano di *Aquinum*, in cui sono sicuramente riconoscibili isolati più grandi di $212 \times 140\text{m}$ (6×4 *actus*), ulteriormente divisi in fasce più strette di 70m (2 *actus*) (da Ceraudo 1999: 161–168)⁸, con varianti nei settori periferici, in particolare quello settentrionale ed in prossimità della linea delle mura (da Ceraudo 2007).

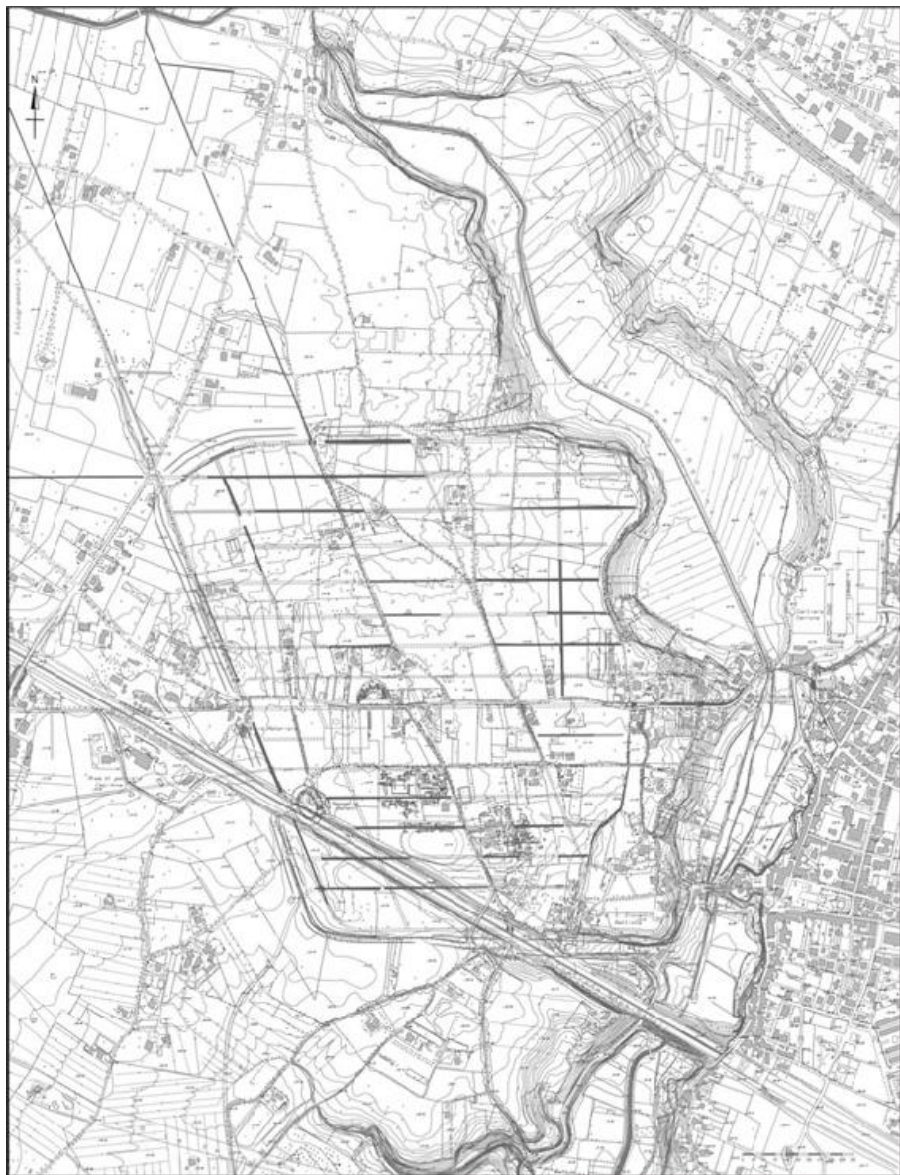


Figura 10.3 Aquinum. Restituzione aerofotogrammetrica finalizzata (G. Ceraudo).

Molte delle immagini aeree utilizzate nell'ambito del ricostruito assetto urbanistico della città antica, hanno consentito di riconoscere in traccia i resti di edifici pubblici e privati in alcuni settori centrali dell'abitato e di definire, con maggiore precisione, il tracciato di alcuni assi viari, sia all'interno della maglia urbana sia all'esterno della linea delle mura (Figura 10.4).

Considerevole la quantità di dati recuperati anche da immagini aeree di tipo prospettico (Figura 10.5): alle foto oblique riprese da colleghi francesi all'inizio degli anni '80, e cortesemente messe a disposizione da Gerard Chouquer (1987) si sono aggiunti, più di recente, nuovi rilievi aerei realizzati

grazie alla collaborazione diretta con il Nucleo Elicotteristi dei Vigili del Fuoco di Roma.

Le numerose tracce in esse contenute sono state opportunamente trattate con software specifici adibiti al ‘raddrizzamento’ delle immagini prospettiche: le foto sono state quindi corrette geometricamente, georeferenziate su punti fiduciali e le tracce, dopo esser state vettorializzate, sono state inserite nella cartografia analitica elaborata. Questa particolare procedura ha permesso la quasi completa ricostruzione di tre isolati ad O dell’anfiteatro e a contatto con la via Montana nel settore meridionale della città (v. Figura 10.3).



Figura 10.4 Aquinum. Foto aerea verticale del 1984 (Aerofotogrammetrica Nistri). 1–3) tracce della cinta muraria; A–N) tracce di assi stradali urbani ed extra-urbani. (Archivio LabTAF).

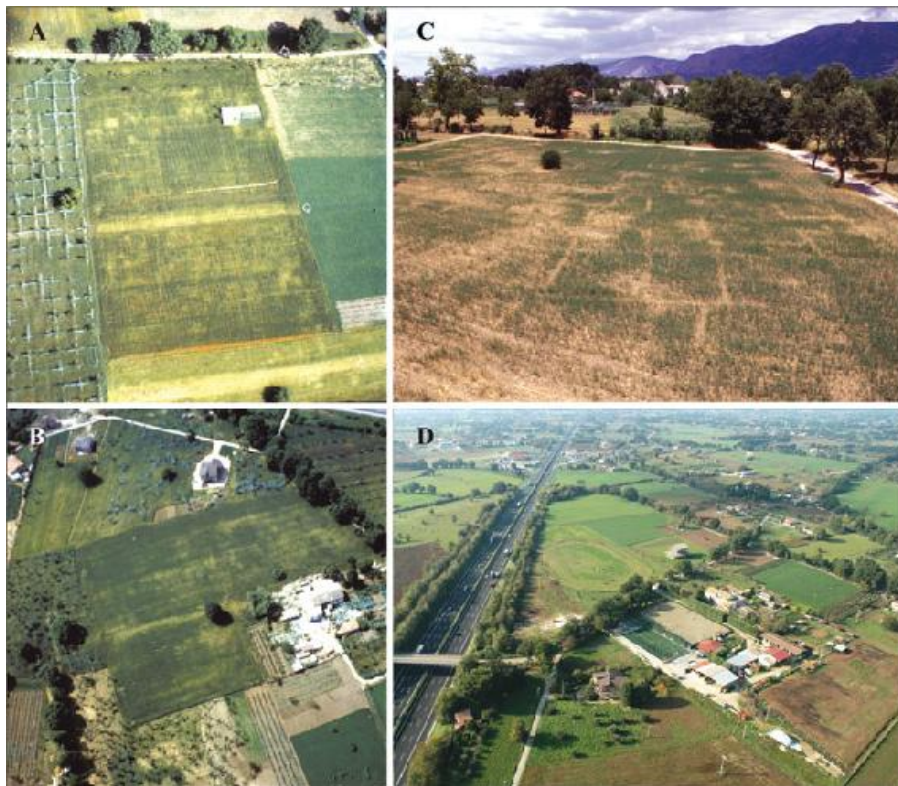


Figura 10.5 Aquinum. Mosaico con alcune foto aeree oblique riprese da studiosi francesi del 'Centro di Ricerca di Storia antica di Besançon' all'inizio degli anni '80 (A–B) (foto G. Chouquer, 1982, CNRS; Coll. École Française de Rome); foto scattata dal tetto di una abitazione privata (C) immagine realizzata grazie alla collaborazione diretta con il Nucleo Elicotteristi dei Vigili del Fuoco di Roma (D) (Archivio LabTAF).

Ricognizione aerea a bassa quota

L'attività di ricerca del laboratorio leccese legata alle immagini telerilevate non è stata limitata soltanto al reperimento di foto aeree verticali ed alla produzione di cartografia finalizzata. Accordi con Enti o Istituzioni abilitati al volo, quali il Nucleo Tutela del Patrimonio dei Carabinieri, il Corpo Forestale dello Stato e il Nucleo Elicotteristi dei Vigili del Fuoco di Roma, hanno permesso di monitorare e documentare con voli mirati l'intera area oggetto della ricerca (v. Figura 10.5).

A partire dal 2005, è stato avviato uno specifico programma di ricognizione aerea del territorio, con rilevamento fotografico a bassa quota e con riprese aeree oblique lungo tutta la valle. Alcune delle numerose immagini aeree a disposizione, hanno permesso di fare luce su un settore centrale dell'area urbana poco a nord-ovest del teatro (Figura 10.6), che fino ad oggi non aveva restituito particolari elementi utili per la definizione dell'impianto. La favorevole combinazione legata alla lavorazione dei campi e la scelta di un periodo ottimale per l'individuazione delle tracce, hanno

permesso di ricostruire un nuovo ampio settore dell'abitato.



Figura 10.6 Aquinum. Veduta aerea obliqua di un settore centrale dell'impianto urbano poco a Nord della via Latina, in cui sono chiaramente visibili in traccia due assi stradali orientati E-O ed alcune grandi domus all'interno degli isolati (Archivio LabTAF; elaborazione grafica G. Murro).

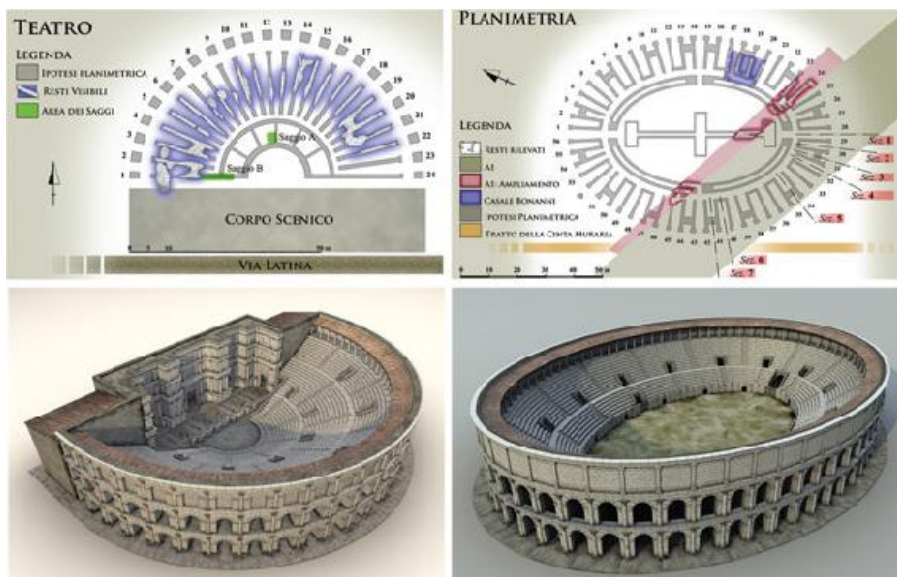


Figura 10.7 Ipotesi di ricostruzione planimetrica del teatro e dell'anfiteatro di Aquinum sulla base dei resti rilevati (in alto) e rendering texturizzato dei rispettivi modelli 3D (da Ferrari 2007).

Precedentemente al volo, grazie all'attività di ricognizione sul terreno

erano state individuate a terra delle aree con una notevole maggiore concentrazione di materiale antico; in seguito alle riprese aeree è stato possibile notare come queste aree di concentrazione siano da mettere in relazione con i resti di edifici isolati allineati lungo gli assi stradali urbani e nitidamente visibili in traccia nelle immagini aeree realizzate. E' possibile ricostruire, quindi, all'interno di un settore che sembrerebbe destinato ad edilizia residenziale, la presenza di alcuni grandi complessi, forse anche delle *domus*, con ampi spazi lasciati liberi all'interno degli isolati. Situazione che risulta decisamente differente rispetto a quella individuata nella parte meridionale dell'abitato ad E dell'anfiteatro, dove invece è stato possibile riconoscere, prima che l'area venisse obliterata da interventi di ampliamento e di scasso all'interno di un centro ippico (v. Figura 10.5, D), alcuni isolati interessati da una maggiore concentrazione e articolazione di edifici, tra cui forse un impianto termale (da Chouquer 1987: 274).

Rilievo e analisi dei monumenti

In punti diversi dell'abitato sono ancora visibili i resti di monumenti in rovina (da Nicosia 2006: 87–104), per i quali è stato avviato uno specifico programma di rilievo e di analisi, seguito da uno studio di dettaglio per la corretta ricostruzione, anche tramite modelli 3D; ciò ha consentito di evidenziare le peculiarità strutturali e architettoniche degli edifici e le relative tecniche costruttive, anche in rapporto all'ambito culturale di appartenenza.

Si tratta: nel settore occidentale dei resti dell'anfiteatro, di Porta Romana e di una torre poco a N, dell'edificio templare (c.d. *capitolium*); nel settore orientale dell'arco onorario detto di Marcantonio, di Porta San Lorenzo e del lungo muro a sud di quest'ultima; nel settore centrale del teatro e dell'edificio absidato. Apprezzabile il coinvolgimento di giovani studiosi, specialisti della materia, che collaborano con grande impegno a queste fasi della ricerca⁹.

Risultati significativi riguardano in particolare i due grandi edifici per spettacolo: il teatro e l'anfiteatro (Figura 10.7), i quali si inseriscono perfettamente all'interno della griglia urbana anche se cronologicamente non coevi¹⁰.

Del teatro rimangono in piedi soltanto pochi resti dei setti radiali in opera quasi reticolata, aveva la *cavea* rivolta verso la *Via Latina* con la scena parallela e l'asse minore ortogonale all'asse stradale. In assenza di attendibili dati di scavo, la datazione dell'edificio – solo sulla base della tecnica costruttiva – oscilla tra la costituzione del *municipium*¹¹, la deduzione della colonia triumvirale¹² nel corso del I sec. a.C. – con quest'ultima ipotesi che sembra essere la più probabile – o ancora, l'età augustea¹³ o più genericamente la prima età imperiale (da Cagiano 1949: 42).

L'anfiteatro, tangente alle fortificazioni, aveva l'asse maggiore parallelo alla linea occidentale delle mura. Sorgeva nel luogo dove alla fine del XVIII sec. venne costruito il Casale Bonanni (di recente purtroppo proditoriamente demolito unitamente a consistenti parti dell'edificio romano), di forma

trapezoidale eretto inglobando quattro dei setti radiali della *cavea* della struttura antica. Nonostante il monumento abbia subito gravi danni a seguito della costruzione dell'autostrada del Sole che ne ha distrutto a più riprese c. 1/3, grazie al rilievo delle parti superstiti prima del recente abbattimento è stato possibile ricostruire nelle linee generali la planimetria e le dimensioni di massima dell'arena¹⁴. Inglobati nella struttura esterna del casale e nelle cantine all'interno dello stesso, erano ancora conservati alcuni dei cunei radiali della struttura, costruiti in opera reticolata con ammorsature in blocchetti parallelepipedi di tufo. Lungo la spalletta settentrionale dell'autostrada sono invece visibili brevi tratti delle murature in opera mista (reticolato-laterizi) dei corridoi anulari dell'arena. In base alla sola tecnica edilizia utilizzata ed in assenza, purtroppo, di attendibili dati di scavo, credo che la cronologia dell'edificio – realizzato sicuramente in un momento successivo rispetto a quello della deduzione della colonia triumvirale – non possa essere messa in relazione con quella del teatro, ma vada spostata alla piena età imperiale¹⁵.

Una volta documentati nel dettaglio, i resti degli antichi manufatti sono stati restituiti all'interno della carta aerofotogrammetrica numerica prodotta ed hanno permesso di puntualizzare e di ridisegnare, in combinazione con i dati desunti dalla fotointerpretazione archeologica, aspetti inediti della forma e dell'urbanistica di *Aquinum*, prestando particolare cura nel loro posizionamento all'interno della griglia urbana (cfr. Figura 10.3).

Prospezioni geofisiche

La necessità di sperimentare strumenti innovativi e nuove metodologie di indagine deriva proprio dalla lunga esperienza condotta con i metodi appena descritti, dalla consapevolezza dei limiti ad essi connaturati e dalla constatazione del progressivo depauperamento delle evidenze di superficie. Per questo motivo sono state avviate una serie di campagne di prospezioni geofisiche con l'obiettivo di testare le potenzialità di questo tipo d'indagine integrando ed incrociando i dati già in nostro possesso, con il proposito di ripetere a breve l'esperienza su più ampia scala. Le prospezioni effettuate hanno coperto per ora una superficie totale di 2ha la magnetometria e c. 7ha il georadar (Figura 10.8), le griglie sono state localizzate e georeferenziate in due settori ricchi di materiale archeologico e di tracce ed all'interno dei quali era già stata effettuata la ricognizione sul terreno¹⁶.

Anche in questo caso i risultati conseguiti sono stati entusiasmanti, confermando pienamente i dati ottenuti con il lavoro di ricognizione e di fotointerpretazione archeologica ed evidenziando ancor meglio la localizzazione delle strutture sepolte (da Ceraudo, Piro e Zamuner 2010).

Scavo archeologico

Alla luce delle indagini aerotopografiche e geofisiche e tenendo in

considerazione tutti gli elementi individuati nel corso delle ricerche descritte, infine, sono state intraprese due campagne di scavo ad *Aquinum* (2009 e 2010), con l'apertura di due saggi esplorativi nell'ambito di un settore centrale della città il cui interesse archeologico è richiamato dal toponimo 'San Pietro Vetere'.

In quest'area, quindi, si sono concentrate le attività di ricerca, in particolare nella verifica della presenza di alcuni assi stradali e di edifici individuati all'interno degli isolati ricostruiti nel settore a ridosso della *via Latina*.

L'insieme degli ambienti scavati è da mettere in relazione ad un grande edificio termale, verosimilmente a carattere pubblico (Figura 10.9). Del complesso termale sono stati portati alla luce numerosi vani: sicuramente tre di questi ambienti dovevano essere riscaldati per mezzo di aria calda circolante sotto il pavimento e lungo le pareti, elementi che li caratterizzano come *caldaria*. Non ancora definita la funzione di un grande ambiente (*frigidarium/apodyterium?*), non scavato integralmente, pavimentato con mosaico a bicromia bianconera. Questo vano del complesso era caratterizzato da una monumentale iscrizione musiva con l'attestazione di due personaggi di rango nel contesto della colonia aquinate, evidentemente promotori della costruzione dell'edificio.

Applicazioni informatiche (banca dati e Sistema Informativo Territoriale)

La complessità della strategia adottata e l'ingente mole di dati acquisiti hanno reso indispensabile la realizzazione di un sistema GIS per l'archiviazione, la gestione e l'elaborazione delle informazioni finora raccolte, logica evoluzione delle ricerche sul territorio, della cartografia finalizzata e della fotointerpretazione. Il Sistema Informativo Territoriale del LabTAF è stato realizzato raccogliendo le esperienze e le tecnologie messe a punto in oltre un decennio di applicazioni attraverso successivi affinamenti in una serie di territori campione rappresentativi della situazione nazionale (da Guaitoli 2001). Il SIT è basato su un quadro generale di riferimento cartografico e su diverse banche dati appositamente strutturate per i vari settori della ricerca (Centri urbani, territorio, monumenti, materiali di scavo, materiali museali, ecc.). Tutti gli elementi archeologici sono inseriti nella cartografia numerica ed associati ad una Banca dati sviluppata in funzione della conoscenza dei singoli beni del territorio: questa contiene tutte le informazioni sui diversi elementi esistenti sul terreno, indicando le condizioni di conservazione, i danni, il rischio, i dati catastali e tutti i tipi di documentazione (storica, grafica, fotografica, cartografica). Come tutti i sistemi GIS la struttura permette, con grande potenza operativa, interrogazioni spaziali, geografiche, alfanumeriche integrate in più direzioni. Come è stato detto, gran parte dei dati sono stati reperiti mediante ricognizione sistematica e schedatura analitica comprensiva anche delle informazioni già note provenienti dalla ricerca storico-bibliografica, da spoglio di notizie di archivio, dall'analisi di fotografie

aeree e dei diversi tipi di immagini aerorilevate comprese quelle satellitari, al fine primario della conoscenza, della tutela e della valorizzazione dei beni culturali quale risorsa strategica per la crescita del territorio; quindi non solo finalizzata alla ricostruzione storicoarcheologica del paesaggio ma volta anche a rinnovare il sistema della tutela in una strategia della valorizzazione.

Risultati e conclusioni

Il programma dei lavori pianificato per *Aquinum*, è stato calibrato su quelle che si riteneva potessero essere le enormi potenzialità archeologiche e le prospettive di ricerca offerte dal sito. Punto fondamentale del progetto ha riguardato le primarie esigenze di conoscenza e tutela dell'area, sottoposta ad una graduale ma costante distruzione causata da lavori agricoli e, in alcuni settori, da arature profonde a carattere estensivo. La programmazione degli interventi esplorativi condotti nel corso di questi ultimi anni ha tenuto conto, altresì, di quelli che sono stati i risultati dell'elaborazione dei dati e della documentazione relativi alle ricognizioni sistematiche sul campo, alle ricognizioni aeree ed alle prospezioni geofisiche effettuate nel corso di oltre un decennio di attività di ricerca dall'Università del Salento¹⁷.

Allo stato attuale delle conoscenze, infatti, la consistenza dei depositi archeologici presenti, l'abbondanza di materiali ed le notevoli tracce messe in evidenza nel corso delle indagini aerotopografiche, costituiscono tutti univoci indicatori di condizioni favorevoli alla programmazione di progetti futuri d'indagine finalizzata al riscontro e alla verifica di quanto individuato attraverso le attività di ricerca scientifica sopra descritte.

Risultati fondamentali, quindi, sono stati conseguiti nell'ambito generale del ricostruito assetto urbanistico della città antica che si è venuto a delineare ed in particolare, attraverso lo scavo, di un settore centrale dell'abitato, caratterizzato da edifici pubblici già noti (teatro, edificio absidato) e di nuova acquisizione al patrimonio archeologico (terme pubbliche). Il tutto, si spera, potrà servire da volano per una migliore attività di tutela del sito anche in previsione di una futura valorizzazione strategica dell'area.



Figura 10.8 Aquinum. Anomalie rilevate con il georadar nel settore centrale dell'impianto urbano nei pressi della Via Latina (da Ceraudo, Piro, Zamuner 2010).



Figura 10.9 Saggio di scavo archeologico relativo ad un edificio termale all'interno della stessa area interessata da indagini aerotopografiche e geofisiche (cfr. le Figs 10.6 ed 10.8).

Notes

1 Ceraudo 2007, 39–48.

2 In attesa della pubblicazione della Carta archeologica di Aquinum, in fase avanzata di

- preparazione, alcune delle novità più interessanti e parte dei risultati dell'attività di ricerca svolta ad *Aquinum*, sono stati presentati in anteprima in Ceraudo 1999, 161–168; 2001, 161–175; 2003, 178–184; 2004a, 13–23; 2004b, 155–181; Spigolature Aquinati 2007.
- 3 Guaitoli 1999; 357–365; Gianfrotta 2002, IX–X.
- 4 Il Sistema è gestito con il software GeoMedia della Intergraph Ltd, mentre per la restituzione grafica dei dati ci si è avvalsi di software CAD di uso comune insieme a programmi specifici per la restituzione fotogrammetrica analitica e digitale; cfr. Guaitoli 2009, 39–62.
- 5 Cfr. *infra*.
- 6 Cagiano de Azevedo 1949.
- 7 Giuliani 1964, 41–49.
- 8 Al momento, facendo una stima di massima del materiale aerofotografico utilizzato, sono state 'lette ed interpretate' 50 strisciate di foto aeree verticali per un totale di oltre 250 immagini; di queste, c. 150 foto sono relative agli ultimi anni del secondo conflitto mondiale scattate dalla Regia Aeronautica Italiana prima e dalla Royal Air Force nella fase finale del conflitto.
- 9 Mi riferisco in particolare al prezioso apporto di G. Murro per il 'capitolium', l'arco onorario e Porta San Lorenzo, e di I. Ferrari per il teatro e l'anfiteatro (Murro 2007; Ferrari 2007).
- 10 La particolare tecnica edilizia adottata per il teatro, completamente differente da quella dell'anfiteatro ma mai messa opportunamente in risalto, fa sì che la datazione dei due monumenti – posta in momenti diversi nel corso del I secolo a.C., o ai primi anni del I sec. d.C. – vada a mio parere rivista (v. *infra*).
- 11 Bellini 2001: 95–125, in part. p. 100; ad una datazione n 'età municipale' di entrambi gli edifici per spettacolo rimanda in Bellini (2004: 90–91).
- 12 Coralli 1964: 53.
- 13 De Rossi 1980: 246.
- 14 58 × 35m l'arena; cfr. Ferrari (2007: 148–150).
- 15 V. nota 6. Ad una datazione ad età giulio-claudia, sempre e soltanto sulla base dell'edito, pensa Golvin (1988: 168–169, 217).
- 16 Le prospezioni magnetometriche (con un Magnetometro in assetto gradiometrico, Overhouser, GSM-19GW, Gemsystem) sono state effettuate in collaborazione con colleghi del Laboratorio di Archeologia dei Paesaggi dell'Università di Siena diretto da Stefano Campana e dal compianto R. Francovich. Le più recenti prospezioni georadar (Ground Penetrating Radar – GPR) sono invece state realizzate in collaborazione con Salvatore Piro dell'Istituto di Tecnologie Applicate ai Beni Culturali (ITABC) del Consiglio Nazionale delle Ricerche usando uno strumento SIR 3000 (GSSI), equipaggiato con una antenna bistatica a 500 MHz ed una monostatica a 70 MHz.
- 17 Cfr. Ceraudo 2007, 39–48; Ceraudo, Piro, Zamuner 2010, 96–100.

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Teano (*Teanum Sidicinum*), Campania*S. Hay, S. Keay and M. Millett***Introduction**

The archaeological survey of Teano (*Teanum Sidicinum*) was initiated in 2002 by Dott. Francesco Sirano of the *Soprintendenza per i Beni Archeologici di Salerno, Avellino, Benevento e Caserta* as part of a broader research project investigating the site. The preliminary results of the magnetometer survey, conducted by a team from The British School at Rome and the University of Southampton, proved highly successful. As a result the project was extended until 2006, under the directorship of Prof Simon Keay and Prof Martin Millett as part of the British School at Rome's Roman Towns Project, and culminated in an expansive geophysical and close contour topographic survey, covering just over 20ha.¹

The town of *Teanum Sidicinum* was founded in the fourth century BC, at a major point of communication between the valleys of Southern Lazio and the plain of Campania. It was a major centre of the *Sidicini*, the people who populated the slopes of Roccamonfina, and following the conquest of the region by Rome (Frederiksen 1984: 182), lay on the line of the *Via Latina* and became one of the most important towns in northern Campania.

Situated on a rock outcrop on the south-eastern slopes of the extinct volcano of Roccamonfina (*Mons Mefineus*), the modern town of Teano overlooks the impressive gorge cut by the River Savone. The geology of the area consists of Quaternary volcanic rocks, derived from two stages of volcanic activity in the Pleistocene from the Roccamonfina volcano (Cipollari and Cosentino 1995: 377; Giannetti 1998: 114ff). The soil deposits are derived from the tuffs and lavas of the range, and therefore have a high magnetic susceptibility (Mullins 1977; Clarke 1996: 99ff).

It seems probable that this location was governed by strategic considerations, primarily the control of the saddle of land between Roccamonfina and Monte Maggiore, and hence the control of access between the valleys to the north and the plain of Campania to the south (Frederiksen 1984: 182). After the first Samnite War (343–341 BC), Sulpicius and Aelius commenced a campaign in 337 BC against the *Sidicini*, *Aurunci* and *Volsci*. L. Papirius Crassus and K. Duillius continued the campaign against the *Sidicini*

and *Teanum* was captured in 336 BC; an alliance was thereafter formed between the protagonists (Frederiksen 1984: 207). Full control of the area was ensured by the creation of two Latin colonies, *Cales* (334 BC) and *Suessa Aurunca* (314 BC). The social, economic and political implications of Roman control are tangible in the archaeological record in the form of inscriptions, locally-minted coins and the worship of Hercules alongside Popluna, an Italic goddess closely linked to the *Sidicini*, in the sanctuary at Teano (Sirano 2007a).

Much of the ceramic material present at the site demonstrates the influence of Etruscan trade along the Tyrrhenian coast and contact with the Samnites to the east. Architectural styles demonstrate work by or influenced by artisans from *Magna Graecia*. Of the archaeological remains of the pre-Roman and Roman town, the theatre and amphitheatre are most prominent, located on the slope to the southeast of modern town whilst stretches of the *Via Latina* are still elsewhere visible winding through the landscape. Much of the medieval and modern town is situated on the foundations of the acropolis of the Hellenistic town, that of the *Sidicini*, and its Roman successor. The gates and defensive walls of the pre-Roman hilltop settlement are clearly visible within the fabric of the modern town of Teano.²

State of the art

There is an enormous body of existing work on individual monuments and finds from Teano carried out by scholars of the earlier twentieth century such as Ashby, Woolley, Maiuri and Della Corte and since the 1960s, by Johannowsky, whose large-scale excavation of the temples in the sanctuary at Loreto led to the discovery of numerous terracotta sculptures. Sirano's most recent work in the same area together with his excavations of the temple of Popluna have revealed considerable new evidence for the development of the city, now also expertly displayed in the new town museum (Sirano 2007c).

Our geophysical survey was designed to complement these studies.³ The aim was to enhance understanding of the urban landscape by locating sub-surface archaeological remains and thereby help place past excavated evidence into a broader topographical context. In addition we mapped all the known archaeological features dispersed across the landscape, providing a close interval contour survey and planning archaeological standing structures. Such a framework is fundamental to comprehending the development of the ancient city and its surviving remains.

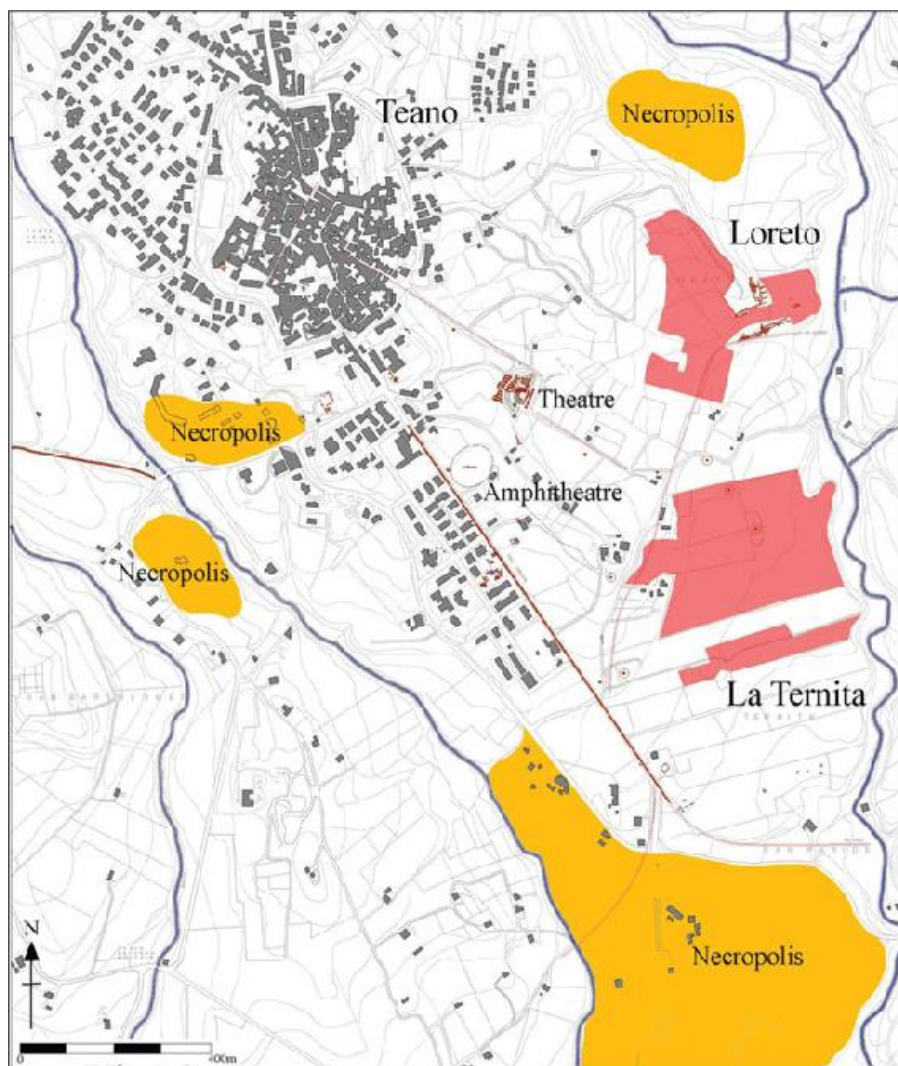
The margins of the modern town of Teano are encroaching on the buried remains whilst much of the rest of the site is now under heavy cultivation; peach orchards, hazelnut trees and tobacco plantations cover a large part of the ancient landscape. Only limited areas were therefore available for survey. Two large open areas were accessible for survey, both on the western terrace above the River Savone, namely the areas known as 'Loreto' and 'La Ternità'

(Figure 11.1).

Methodology

Topographic survey

An understanding of the nature of the ancient landscape on which the modern urban sprawl of Teano lies can only be achieved through detailed documentation of the topography and standing archaeological remains.⁴ This aspect of the project is still in its infancy and so far, only one season of comprehensive topographic survey has been completed. However, as a resource it is already proving essential to explaining the nature of the geophysical survey results in La Ternità.



The survey aimed to record the present day topography (field boundaries, tracks and buildings) in sufficient detail so that our plan could be reliably related to the published maps. The survey was carried out using a Leica TC 805 total station recording spot height elevations at approximately 5m intervals. It was not our intention to make detailed building surveys of standing monuments, more to record their presence and to determine the relationship between them and the topographic and geophysical survey results. The extension and completion of the topographic survey is planned for the near future.

Geophysical survey: magnetometry

The pilot season of magnetometry in 2002 at Loreto proved highly successful in terms of the magnetic response of the buried archaeological features and it was deemed the most suitable geophysical survey technique with which to study the urban landscape of Teano given the scale of the project. Continued work at Loreto, expanding on the initial results took place between 2003–4, and then in the following two years the focus of the survey work turned to La Ternità.

The magnetometer survey has been instrumental in mapping the nature and extent of the archaeological buried remains, from small individual structures to large complexes and the layout of the infrastructure. It was undertaken using Geoscan Research FM36 and FM 256 Fluxgate Gradiometers. Readings were taken at 0.5m intervals along traverses every 1m. The depth to which the Geoscan instrument can take readings varies with the geology but is usually up to 1m.

Results

Loreto

The various terraces that comprise the area known as Loreto cover an area of about 10ha that flanks the western edge of the steep gorge of the River Savone. The local topography is varied, although there is an overall gentle downward slope from north to south. One terrace projects to form a promontory and it is here that Johannowsky excavated a series of adjacent temples and in so doing, clearly identified a major sacred sanctuary of the *Sidicini* that covered c. 2ha (Figure 11.2) (Johannowsky 1963).

Our geophysical survey was designed to enhance knowledge of this complex (Figure 11.3). The sanctuary comprises two terraces: the upper one, referred to by Johannowsky as Terrace III, was the focus of our initial survey. This terrace gently slopes down to the west to the lower terrace, referred by Johannowsky as Terrace II, and is flanked on either side by extant remains of

ancient buildings. A rectangular anomaly detected in the geophysical survey was provisionally interpreted as a temple and was subsequently excavated by the *Soprintendenza per i Beni Archeologici di Salerno, Avellino, Benevento e Caserta* confirming this identification (Figure 11.4) (Sirano 2007b). The excavations revealed the plan of a temple structure with two major phases. In the earlier phase, dated to the first half of the fifth century BC, the sanctuary was dedicated to Popluna on the basis of what have been identified as terracotta representations of the goddess found there (Sirano 200b7: 87–88). Between the end of the third and early second century BC, as part of the reorganisation of the sacred space in the sanctuary, the earlier temple was demolished in a formal ceremony leaving only its foundations that were incorporated into the subsequent rebuild of the temple, dedicated to Iuno Popluna, and which continued in use until at least the second century AD.



Figure 11.2 Photo of the area of the sanctuary of Teano seen from the west.

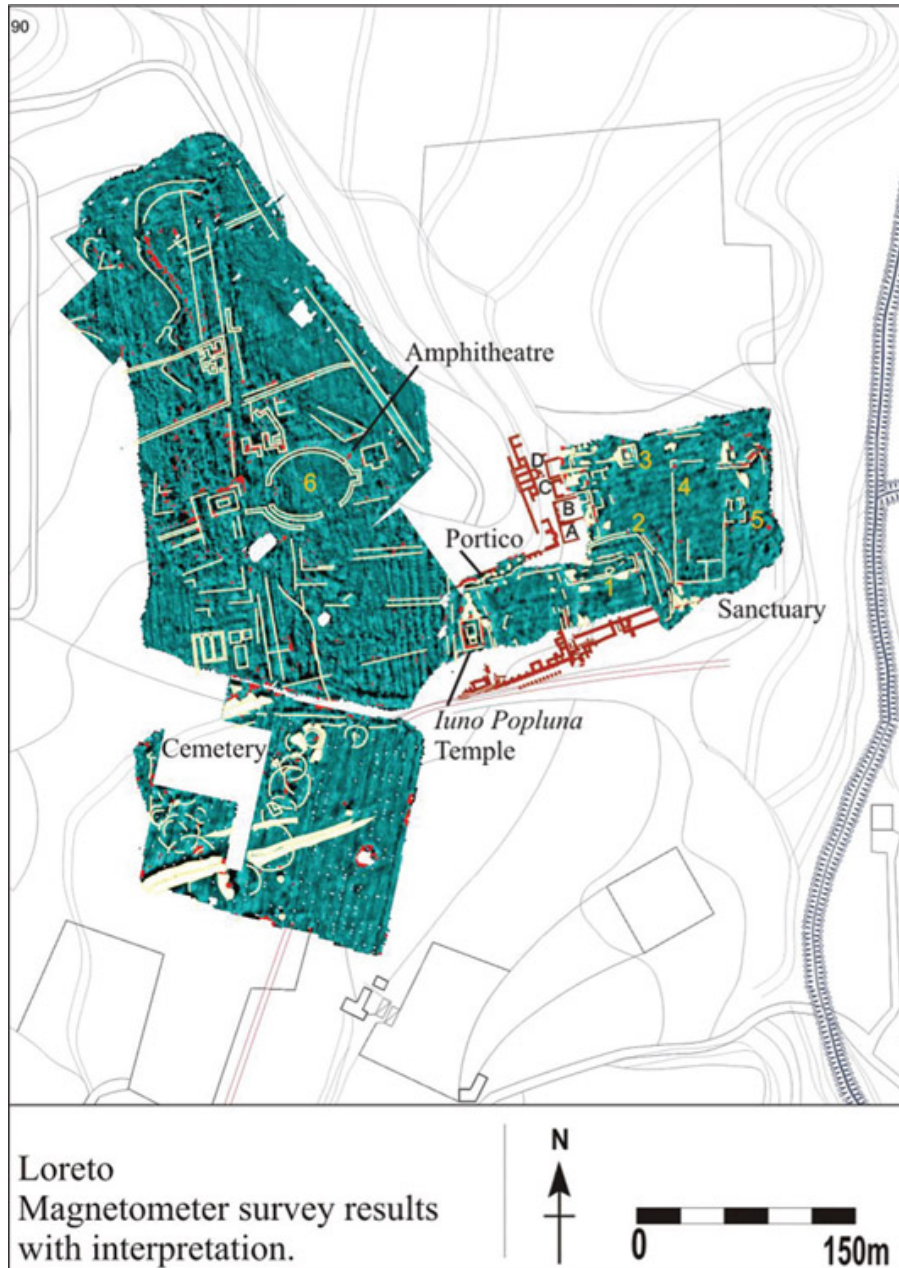


Figure 11.3 Interpretation of the magnetometry results for Loreto.

A further campaign of geophysical survey in 2003–04 sought to enlarge the area surveyed and encompassed the easterly slope down to the lowest terrace that overhangs the gorge (Figures 11.2 and 11.3). The temple detected in the 2002 survey appears to be linked to a series of anomalies lying to its north. Judging by Johannowsky's excavations it was along this northern edge that he unearthed a portico which was found to link Terrace II and Terrace III

(Johannowsky 1963: 133). Johannowsky also discussed a 'ramp' that connected these terraces and initially it was assumed that a large rectangular feature, lying down slope to east of the temple of Iuno Popluna and adjacent to the portico represented the remains of this.

However the morphology of this anomaly, with its apparent internal divisions, suggests that its interpretation is more complex. It appears to be contained within a polygonal enclosure and has other structures associated with it. The most obvious interpretation of this building, which measures 42m × 12m, is that it was a temple housed within a walled *temenos*. Lying to the north of this are the extant remains of an arched substructure dating to the second half of the second century BC that appears to act as both a revetment and support for the terrace above. Johannowsky's excavations reveal that immediately to the east of this was a row of four further adjacent temples, A, B, C, and D, that were dated to between the third and the second centuries BC (Johannowsky 1963: fig. 2).

The magnetometer survey on this terrace revealed clear evidence of these four temples along the western margin of the survey area and perhaps revealed a fifth temple in this sequence beyond the limits of the excavation. Associated with this is a clear rectangular anomaly measuring 12m × 10m. Within this there is a small amorphous positive anomaly that probably indicates the presence of a central feature. If this rectangular complex is interpreted as a further temple within the sanctuary, then the central anomaly might represent a plinth or altar.

In addition to this temple complex there would appear to be a further enclosure to the east. The survey results produced a series of anomalies belonging to a massive (70m × 30m) rectangular building oriented north-south, with traces of internal divisions at its southern end. There are also traces of a probable temple with internal *cella* mid-way along its eastern side. If this complex is part of a ritual area associated with the sanctuary, then it is dominated by open space. Interestingly, the entire enclosure and its associated components, although on a slightly different alignment from the other features on the two terraces, do not overlap with them. This strongly suggests that although this rectangular building may belong to a different phase from those of other structures within the sanctuary, all of them respected each other in spatial terms. The geophysical survey has thus substantially enlarged our knowledge of the sanctuary as a whole, revealing new buildings and providing a much clearer idea of the spatial complexity of the sacred landscape.

The southern part of the area surveyed at Loreto is dominated by a complex series of circular features interpreted as archaic tumuli in a range of different sizes (varying from 8m to 14m in diameter). Their overall distribution does not appear to have any regular structure, whilst some clearly respect each other, others overlap. The evidence strongly suggests that this burial area was used over a long period of time with successive burial mounds not always respecting earlier ones. Comparable burial monuments are more

commonly associated with areas further north such as Necropoli di Fossa which clearly demonstrate parallels with the features at Teano (Cosentino 2003). However, similar funerary traditions have been discovered south of Teano in the Sarno Valley so their identification here is plausible (Gastaldi 1979).

The predominant model in the archaeological record is for an archaic cemetery to pre-date the founding of a sanctuary. It would thus be interesting to clarify the date of the burials at Teano in order to assess whether the temples and burials were contemporaneous or whether the sanctuary did indeed succeed the cemetery.



Figure 11.4 Excavation of the temple of Iuno Popluno.

The final area of geophysical survey at Loreto lay to the north of the tumuli and to the west of the sanctuary. The results from the large area examined here reveals a more familiar image of what appears to be articulated urban space. In the central section is a grid of roads. There is a single street on a north–south alignment running across the centre of the area and another diverging from it that runs northwest–southeast along the eastern margin of the survey, apparently leading to the sanctuary. A series of four lateral roads cross the area, continuing further to the west beyond the survey area. The result is a street grid which is neither orthogonal nor entirely regular. One gains the impression that it has been established to connect existing features and to take advantage of the natural topography. Recent excavations elsewhere in Teano, both along the line of the ancient *Via Latina* (Sirano *pers comm.*) and in our own survey work at La Ternità (see below) have similarly revealed side streets that did not meet at right-angles to the principal road but rather at an oblique angle. Within this street grid there are clear indications of rectilinear buildings flanking the roads, mainly focused on the frontage of the north–south street. One of these has been interpreted as a temple with a *temenos* wall surrounding it. The function of other structures is unclear.

The most striking structure to have been revealed by the survey is the

large oval feature in the centre of the street-grid, measuring about 50m along its longest axis. The clarity of this plan means that it is difficult to consider any other interpretation for this other than as an amphitheatre. In size, it is comparable to that of *Falerii Novi* (Keay *et al.* 2000: 89; Hay *et al.* 2010). The only problem raised by this identification is that another, extant amphitheatre exists at Teano, dated to the first century BC (Welch 2007: 216–220). Whilst this newly discovered amphitheatre may be a precursor to the latter, it seems more likely that both were used concurrently, perhaps serving different functions. The juxtaposition of the newly discovered structure with the sanctuary and ancient burial ground might support the idea that it was associated with funerary games.

The unfolding landscape at Loreto reveals an extensive and complex sanctuary environment which developed between the *c.* fifth century BC and the second century AD; it is unclear, however, whether it extended on to the main terrace. The survey has enhanced our understanding of this and also reinforces the hypothesis that the sanctuary was peripheral to the main urban settlement (Johannowsky 1963: 133), given the close juxtaposition of the amphitheatre and the archaic cemetery.

La Ternità

The area of La Ternità is located to the south of Loreto and lies on a broad terrace that also flanks the course of the River Savone (Figure 11.5). The survey area comprised a large open field on a gentle gradient sloping down towards the southeast. To the west, the terrace is defined by a steep slope rising above the plain along the foot of which runs a farm track. Substantial fragments of Roman walls and a vaulted structure are visible amongst the undergrowth along the edges of this track. In the centre of the survey area a dense patch of overgrown woodland shrouds the remains of Roman vaults and fairly large walls, possibly belonging to a bath complex. The fabric of these standing structures shows that this area formed part of the urban centre of Teano.

The magnetometer survey in this area revealed extensive evidence of the urban landscape within a complex street system (Figure 11.6). In the north of the area surveyed, a pair of anomalies running northwest–southeast represent a major road line. These features are on the same alignment as the axis of the theatre and a continuation of their line would appear to lead directly up to the ancient acropolis (by way of the modern Calata San Pietro). This would suggest that it formed a major element in the town plan. Two different street axes are revealed by our survey in the area to its south. To the west a parallel pair of streets *c.* 125m apart are aligned south-southwest to north-northeast, and to the east another pair of streets *c.* 100m apart run roughly north-northwest to south-southeast, converging slightly towards the north. At the south-eastern corner of the survey, is a street that runs between the two. These results reveal a grid system with a complex history that cannot yet be fully

understood although it is evident that in its final phase all the streets were in use contemporaneously.



Figure 11.5 View of the area of La Ternità seen from the west.



Figure 11.6 Interpretation of the magnetometry results for La Ternità.

Numerous buildings fill the areas between the streets with their alignments determined by them. They include a number of substantial structures, the functions of which have yet to be fully considered. The overall character of the remains suggests a fully occupied urban landscape. The interpretation of the structures within the central area of the survey at La Ternità is tentative since the anomalies are not always clearly defined despite the relative

‘quietness’ of the overall background responses. General trends and alignments can be discerned but the finer details are less clearly defined. It is hard as yet to attribute functions to the majority of isolated structures defined in the survey on the basis of the form and plan. Overall, the results in the western third of the survey were the least clear. The reason for this is probably related to the fact that the background ‘noise’ levels were higher here than anywhere else in the survey and defining individual anomalies was difficult. However, the high levels of background disturbance do suggest the presence of a dense distribution of buried building material. Frequent surface finds of stone, tile, ceramic and marble, all the material one would use to identify dense urban occupation, certainly confirmed this.

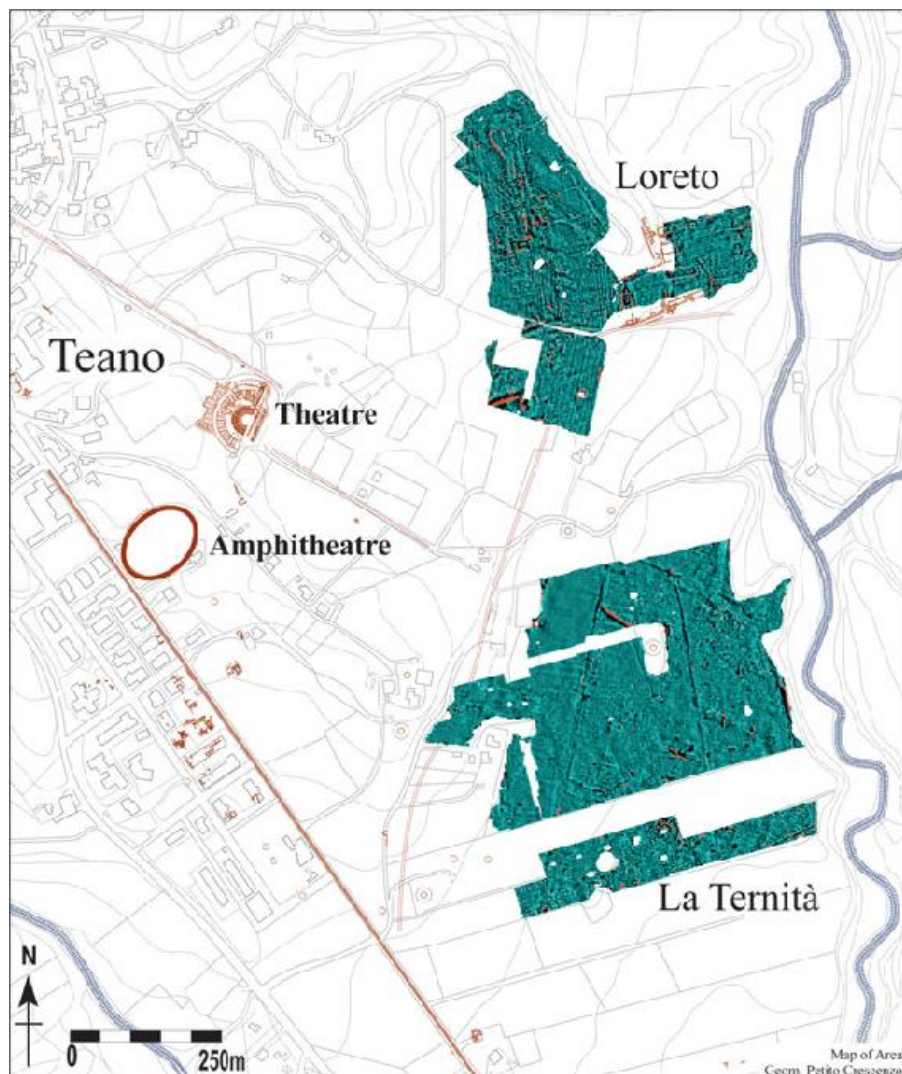


Figure 11.7 Combined image showing Loreto and La Ternità within the broader context of the lower town of Teanum Sidicinum.

In contrast to these built-up areas, the parcel of land in the extreme northwest of the survey area, between two of the principal north–south roads, is curiously ‘quiet’ in terms of identifiable features. The smoothness of the response suggests that this area was open territory. The relative flatness of the ground as revealed by the topographic survey, the overall lack of features, and the impressive dimensions of the area, over 100m by 70m, suggest that one interpretation could be that this is the site of a Roman precinct, perhaps a forum. There are no obvious identifiable civic buildings in the vicinity but the contrast between this area and the seemingly rich urban landscape in the rest of the survey area is notable. Whatever its precise interpretation, it is crucial to our understanding of the topography of the town, its development and growth.

The extensive survey at La Ternità has revealed a complex and intricate urban landscape. The local topography may have shaped the development of the town plan and has certainly assisted the interpretation of a possible Roman precinct and may help explain the elaborate road system. It had been thought that the road grid of the town coincided for the main part with the modern field boundaries and could be plotted directly from aerial photographs. The magnetometer survey has clearly demonstrated that this is not the case. The pattern of ancient urban development is clearly masked by modern features and is complex in itself. As the survey continues to increase its coverage of La Ternità, a powerful new image of *Teanum Sidicinum* as a thriving and complex settlement is emerging.

Conclusions

These results clearly demonstrate that intensive geophysical and topographic survey can enhance our understanding of the topography of ancient *Teanum Sidicinum* (Figure 11.7). While further fieldwork is still required if we are to maximise our understanding, one should not underestimate the considerable challenges that this offers, since the town covers a very extensive area, with much of it being covered by either the modern town or by trees and other kinds of vegetation. In addition, the magnetometry results require continued analysis and discussion. Nevertheless the evidence collected to date allows us to make two important points (Figure 11.6). The first is that the exploration of the sanctuary at Loreto has provided valuable new information about the topographic development of a site that had previously been partly excavated. This new evidence firstly suggests that the sanctuary needs to be understood in the context of an earlier cemetery. It is also starting to show how the archaic sanctuary was later integrated into the urban landscape through the construction of streets and an amphitheatre. The second point is that at both Loreto and La Ternità the survey has revealed a complex street system which hints at a long and historically complicated sequence of urban growth with different phases of planning. It is now a priority to integrate this new evidence

with that from older work within a sound topographical framework so that we can further appreciate how the different elements of the town fit together and were articulated. By doing this, and completing further survey of available land within the city we believe that survey, even in these difficult conditions, can make a very significant contribution to the understanding of the development of this major urban centre in the Hellenistic and Roman periods.

Notes

- 1 The authors would like to acknowledge the financial support of the MacDonald Institute and the Faculty of Classics at the University of Cambridge, the University of Southampton, the British School at Rome, the Society for the Promotion of Roman Studies, and the *Soprintendenza per i Beni Archeologici di Salerno, Avellino, Benevento e Caserta*. In particular they acknowledge the constant support and encouragement of Dott. Francesco Sirano of the *Soprintendenza per i Beni Archeologici di Salerno, Avellino, Benevento e Caserta*, and Professor Andrew Wallace-Hadrill.
- 2 Raiola 1922: pull-out map at end
- 3 The authors would like to acknowledge the involvement of Eamonn Baldwin, Rose Ferraby, Paul Johnson, Kristian Strutt and Mark Tibble in this fieldwork as well as all the students from Cambridge.
- 4 The authors would like to thank Tim Sly who supervised the topographic survey.

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Geophysical Prospection in the Vesuvian Cities

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Introduction

The last 20 years have seen major advances in the use of geophysics to further our understanding of Classical towns. The British School at Rome (BSR), in conjunction with the Archaeological Prospection Service of the University of Southampton (APSS), has played a part in this, undertaking extensive survey at a number of major sites in Italy, and throughout the western Mediterranean (Keay *et al.* 2007; 2008), revealing the plans of major settlements like *Falerii Novi* (Keay *et al.* 2000) and *Portus* (Keay *et al.* 2005) raising important archaeological questions, as well as providing an important management resource. Each site has presented archaeological challenges and technical issues, resulting in the development of customised fieldwork and survey strategies for each instance. In most cases, the integration of techniques has proved the best way to maximise the archaeological return from each site.

Geophysical prospection of ‘green-field’ archaeological sites has become a commonplace, non-destructive and cost-effective method for generating high-quality results and interpretations usually through (though not limited to) the use of magnetometry or resistivity. These prospection methods have proven themselves beneficial in providing an idea of the urban context of a site prior to undertaking excavations, as well as within broader-based regional surveys. In contrast, geophysical surveys of deeply stratified urban deposits are less frequent. This is principally due to the their complex stratigraphic sequences and the lack of survey areas of suitable size, all resulting in complicated and large data sets from which to derive meaningful archaeological interpretations. Furthermore the number of applicable prospection methods is more limited than for ‘green-field’ sites, making Ground Penetrating Radar (GPR), the principal survey method within urban contexts.

This paper builds upon recent experiences by the British School at Rome and University of Southampton team in the use of Ground-Penetrating Radar and Electrical Resistance Tomography (ERT), and presents the results of recent work at the Vesuvian towns of Pompeii and Herculaneum. Surveys

were conducted at the site of the *Basilica Noniana* in Herculaneum, and within *insulae* VIII.7.1–15 at Pompeii, as part of the Herculaneum Conservation Project (HCP)¹ and the Pompeii Archaeological Research Project: *Porta Stabia* (PARP:PS),² respectively.

Although both of these ancient towns present a number of challenges to geophysical prospection, previous surveys have been conducted at both sites within recent years, mostly on excavated or partially excavated areas (Albiach *et al.* 2007, Barone *et al.* 2007, Carrara *et al.* 2001, Di Fiore and Chianese 2008, Pettinelli 2006, Santoro 2007). At Herculaneum, a team from the Universities of Naples and Lecce conducted an ERT and GPR survey over the mosaic floor surface in the *Casa dell’Atrio a Mosaico* (Carrara *et al.* 2001). The surveys detected the extent of the cistern, as well as pre AD 79 structures, concealed beneath the mosaic floor. The benefit of this type of investigation, as opposed to the use of excavation, over an area of intact mosaic, is abundantly clear. Geophysical surveys in Pompeii include the study of the *Casa dei Postumii* and *Terme Stabiane* by Eastern Atlas in collaboration with the *Deutsches Archäologisches Institut Rom*.³ The combined ERT and GPR results from the *Terme Stabiane* revealed the location of a series of water pipes feeding the bath complex. The *Via Consolare* Project⁴ used both ERT and magnetometry to identify buried structures in both the *insula* VII.6 and the area of the *Villa delle Colonne a Mosaico* in order to understand the early phases of the houses and to answer some broader research questions about the development of the city of Pompeii.

The widespread use of geophysical survey at Pompeii and Herculaneum may have been precluded by major challenges including the fact that only open areas are buried beneath a deep over-burden of volcanic material, and that many areas available for survey lie within buildings that have already been excavated – in most cases down to AD 79 levels. Notwithstanding these challenges, this paper explores the challenges and potential contribution that geophysics can make to our understanding of both these towns.

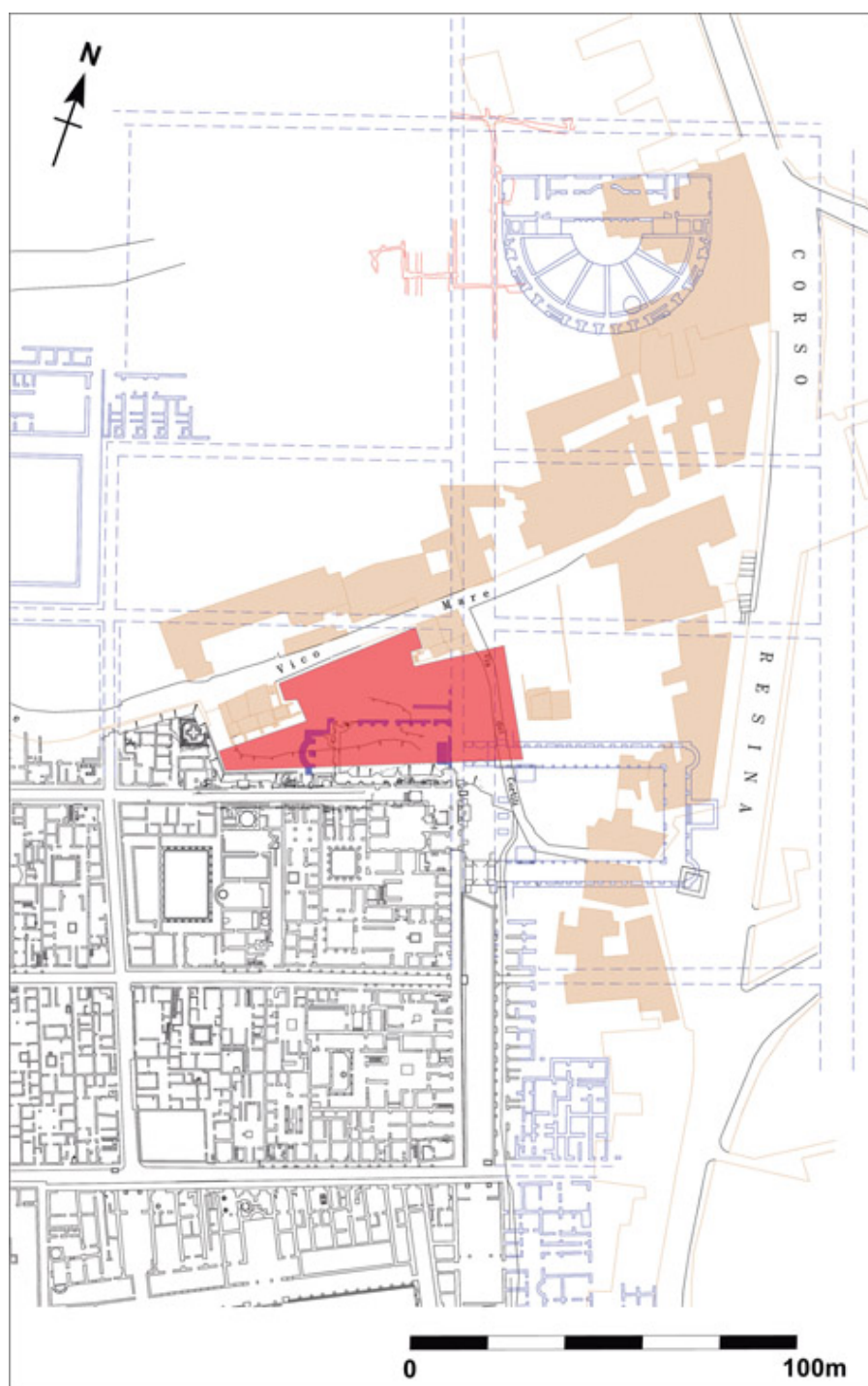


Figure 12.1 Plan of Herculaneum showing the location of the survey area. Image: Studio Brizzi/HCP.

Herculaneum

The archaeological context

The *Basilica Noniana*, located in the northern corner of the archaeological park of Herculaneum, was the site of this geophysical survey (Figure 12.1). Originally the site of the *Basilica Noniana* was investigated during the Bourbon period of explorations in the first half of the eighteenth century that resulted in the discovery of statues, inscriptions and wall paintings and the creation of plans of the building. Once the explorations were completed the tunnels were back-filled and only during the open-air excavations of the ancient city in the 1960s was the outer south wall of the building uncovered. Over the last two decades of the twentieth century, the escarpments overhanging the *Basilica Noniana* had crumbled and buried this area again, until it was re-excavated in 2006 in the context of the HCP.⁵

A feasibility study that included an assessment of the implications of completing the excavation of the *Basilica Noniana* was recently prepared by the HCP's lead architect and archaeologist with a view to developing proposals to improve the northern corner of the archaeological park and the area of the modern town above. After careful evaluation, it was concluded that excavation was the only realistic solution for resolving the serious conservation issues relating to the building, given that it is currently only partially excavated and protrudes from unstable elevated site edges. Preliminary works were carried out in 2009. Archaeological cleaning was carried out throughout the area and some Bourbon tunnels were partially emptied of their backfill in order to better understand the layout of the *Basilica Noniana*, to evaluate the state of conservation of structures and decorative features, and to establish whether any other buildings existed along the basilica's northern edge. This final question was essential for defining the limits of a hypothetical excavation campaign. The recent archaeological work within the eighteenth-century tunnels provided information about the site that had not been previously recorded. Furthermore, their excavation also allowed the outer north wall of an apsed room on the western side of the *Basilica Noniana* to be explored for the distance of a few metres, revealing a room that still preserves its rich fourth-style wall paintings. Also of interest was the clearance of a tunnel which continued through the north wall of the *Basilica Noniana*. Beyond this tunnel was found another structure of which three rooms were partially excavated. By the end of this campaign of archaeological research it was possible to confirm the overall accuracy of Bellicard's 1750–51 plan of the *Basilica Noniana*⁶, to which can be added the new discovery of another building lying to its north, but whose dimensions and functions are not yet known.

Survey methods

It was in the context of this work that a geophysical team from the British

School at Rome and the University of Southampton (APSS) joined the HCP team in January 2009. The primary aim of the survey was to assist in the location of the network of Bourbon tunnels, and to estimate the nature and extent of the archaeological structures still covered by modern construction debris and hard volcanic material from the AD 79 eruption, in order to inform potential excavations (Ogden and Strutt 2009).

As with all geophysical surveys, the team was constrained by the nature of the site conditions in choosing and designing the strategy best suited for prospection. The conditions at Herculaneum are best understood when one considers the location of the *Basilica Noniana* within the modern day city of *Ercolano*. The survey area was situated on the northern edge of the excavations close to the *Decumanus Maximus* and lay in the vicinity of modern buildings and surface obstructions, below which lies a complex stratigraphic sequence of up to 10m of volcanic deposits, and the remains of the *Basilica Noniana* itself.

Viewed in the light of these conditions, two complementary geophysical survey methods, well suited for identifying archaeological remains at depth, were chosen. GPR was chosen as an ideal, high-resolution method for detecting contrasting subsurface remains at increasing depths. The survey was conducted using a 250 MHz and a 100 MHz antennae with the intention of collecting radar reflections at varying depths and resolutions, to assist in determining the optimum “range-resolution trade off” (Davis and Annan 1989, Jol and Bristow 2003) for the site conditions at Herculaneum (Figure 12.2). ERT was also selected, with the aim of detecting the contrasting apparent resistivities between the air-filled voids and artificial fills of the tunnels and the pyroclastic flow through which the tunnels were cut. In addition, ERT was chosen as a mechanism for collecting complementary geophysical data about the nature and depth of anomalies for the calibration and interpretation of the GPR results (Figure 12.3). A topographic survey was also conducted within the survey area, and was used to correct both the GPR and ERT data for changes in elevation, as well as for geo-referencing the survey results into the existing excavation grid and elevations.

The total area surveyed covered *c.* 1ha, although obstacles such as modern building remains, fences, surface debris, and undulating terrain prevented total coverage with either the GPR or ERT. GPR data collection was conducted using a MALA X3M shielded 250 MHz and 100 MHz antenna at 0.5m line spacing in the x-direction with both antennae. A TIGRE resistivity meter was used to automatically collect ten 60m profiles with 1.0m probe separations using an expanding Wenner array. Due to the nature of ERT data collection, the 60m long profiles permitted a depth penetration of approximately 10m below ground-surface, allowing comparative three-dimensional data sets to be generated.

Various data processing steps were taken to produce and integrate both the ERT and GPR data sets. All radar signal and image processing was done

using GPR-slice v6.0. Radar range gaining and wobble reduction was made to boost amplitude reflections at depth. Given the varying elevations within the survey area, topographic correction was also incorporated through the creation of level time-slices and ‘overlay analysis’ (Goodman *et al.* 2006) in order to view the radar data at multiple elevations for both the 250 and 100 MHz data sets. Time-slices were integrated with the site grid, and overlaid with pre-existing excavation spatial data within the Geographical Information System (GIS). The ERT data was processed using Res2DInv inversion software allowing for least-squares inversion and topographic correction of the apparent resistivity values for each profile. The logarithmic contours of each display were clipped to ‘normalise’ the colour ramps between each profile and facilitate an easy comparison of profiles.

Particular emphasis was placed on the use of three-dimensional visualisation methods with a focus on creating an improved mechanism for interpreting the two data sets simultaneously. Three-dimensional volumes were created that incorporated topographic, radar, and ERT data within GPR-slice OpenGL software. These volumes allowed for the manipulation and interpretation of ‘level’ horizontal ERT and GPR slices, as well as ‘isosurface’ models for specified ranges of interest for amplitude and resistivity.

Results

At Herculaneum the successful detection of subsurface features using ERT relied heavily upon the degree to which the interface between the infilled tunnels and the surrounding sediments contained significant differences in apparent resistivities. Although the nature and survey resolution of the ERT method prevented the detection of small-scale features, it did generally detect high-resistivity anomalies in the vicinity of the known structural remains related to the *Basilica Noniana*. ERT proved particularly successful in identifying a number of broad areas of low-resistivity lying to the north of the basilica which, on the basis of their depth and dimensions, have been interpreted as backfilled tunnels. One anomaly, which measured approximately 4m wide and began at 2m below the modern ground surface at the northern edge of the *Basilica Noniana*, was confirmed during subsequent trial excavation as a tunnel (Figure 12.4).

This project has allowed for an in-depth exploration of numerous issues which are typically encountered when surveying complex urban archaeological sites. Geophysical methodological questions were explored, such as the “range-resolution trade off” (Davis and Annan 1989, Jol and Bristow 2003) allowing for recommendations to be made for future surveys at Herculaneum. It was hoped that the size and nature of the broad Bourbon tunnels would allow for detection through the use of both the 100 MHz and 250 MHz GPR antennae. Within the 250 MHz results, linear anomalies, interpreted as structural remains of the *insulae* to the west of the *Basilica*

Noniana were detected. Additional linear anomalies to the northeast of the *Basilica Noniana* along the trajectory of the *Decumanus Maximus* were also observed, potentially confirming the presence of standing remains in this area (Figure 12.5). It was hoped that the size and nature of the broad Bourbon tunnels would allow for detection through the use of both the 100 MHz and 250 MHz GPR antennae. In contrast, although the use of a 100 MHz antenna was successful in reaching the appropriate depth for the base of known archaeological remains, differences in conductivity, moisture content, and RDP⁷ of the intricate subsurface stratigraphy are likely to have caused extensive radar-wave attenuation. On the whole, the 250 MHz GPR was successful in locating previously unknown linear features near the *Basilica Noniana*, while the contrasting resistivities of the tunnel fills and the surrounding matrix of pyroclastic materials made the tunnels clearly detectable by the ERT. In short, integrated survey methods proved vital in the overall understanding and interpretation of the geophysical results on this complex site.

During the course of the project a significant effort was made to assess, compare, and contrast the geophysical results with data from trial tunnel excavation and areas of the site that were accessible at the time of the survey. Though the limitations of the survey techniques constrained the resolution at which known features within the *Basilica Noniana* could be detected, broader anomalies of interest such as the tunnel to the north of the basilica were confirmed soon after the survey season, once tunnel clearance had commenced. It also revealed the potential of geophysics in detecting archaeological remains at a depth of *c.* 10m below modern ground level. Overall, therefore, this survey further confirmed the presence of an unprecedented system of disturbances and a complex stratigraphic sequence overlying the unexcavated remains in this part of the ancient city of Herculaneum. It also revealed the potential of geophysics in detecting substantial Roman structural remains at a depth of *c.* 10m below ground level. The opportunity to calibrate results with those of the reopening of Bourbon tunnels was of fundamental importance in interpreting the unusually complex results.



Figure 12.2 ERT survey underway at Herculaneum.

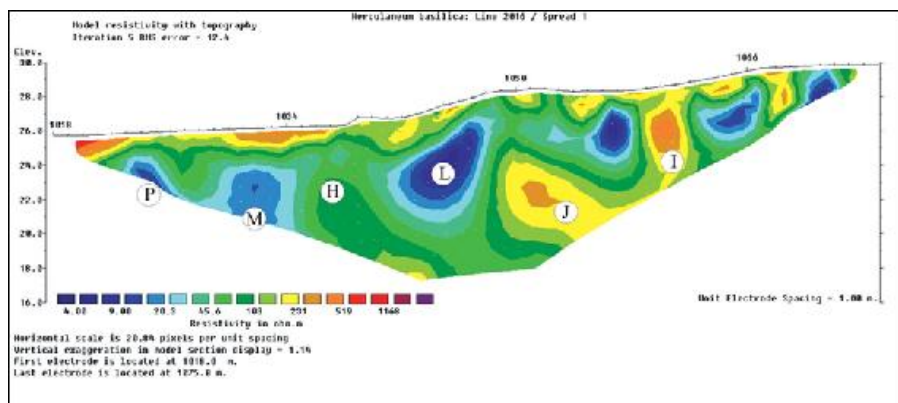


Figure 12.3 ERT Profile N2016 from Herculaneum: Note the low resistivity (blue) anomaly 'M' at the location of a confirmed Bourbon tunnel.



Figure 12.4 GPR Survey underway at Herculaneum.

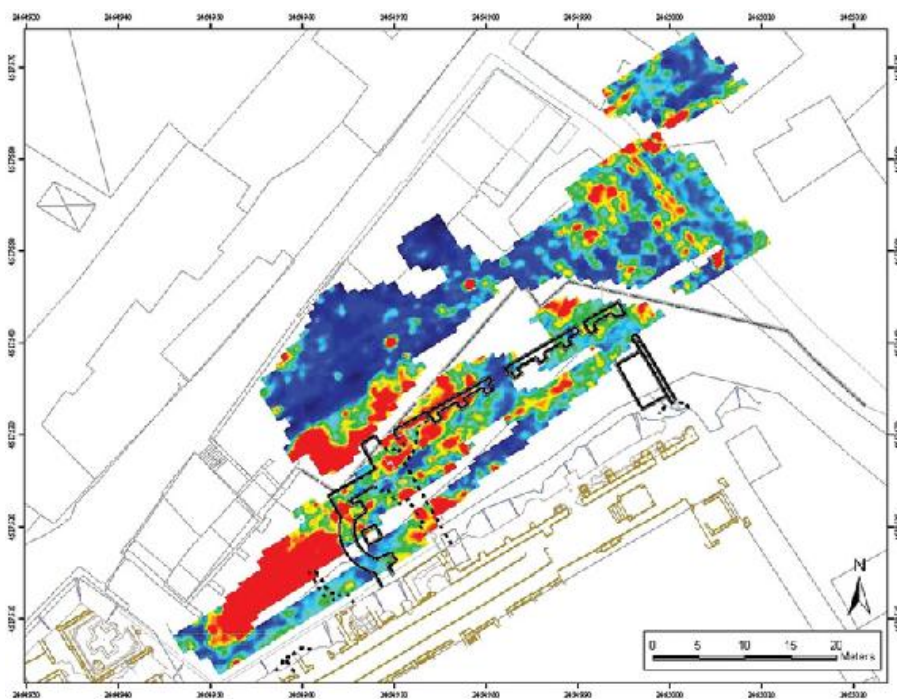


Figure 12.5 GPR 'overlay' timeslice between 12.9–35ns from Herculaneum indicating high amplitude linear anomalies in red.

Pompeii

The archaeological context

The geophysical survey at Pompeii was conducted as part of the University of Cincinnati's 'Pompeii Archaeological Research Project: *Porta Stabia*'

(PARP:PS). PARP:PS began a campaign of excavations in the summer of 2005 to reveal the dynamic structural and social history of a 'workingclass' Pompeian neighbourhood.⁸ It focused upon an area in the southern part of the city that included two *insulae* – VIII.7.1–15 and I.1.1–10 that flank the southernmost end of the *Via Stabiana* and the *Porta Stabia*; it also included some related investigations of the adjacent *Odeion* and the *Quadriporticus*⁹ (Figure 12.6).

The preliminary aims of the PARP:PS have been to firstly define the limits and configuration of properties within both *insulae*, and then to uncover and characterise the complete sequence of social and urban activities that defined this corner of the city. Over the six seasons since 2005 thirty-three trenches have been opened across this area, which combined with architectural and artefact analyses, together with the current geophysical survey under discussion, have uncovered the full sequence of human occupation in the area – from identifying the important layering of geological events (both natural and artificial) to charting the developmental history of each of the ten properties through to AD 79. The examination of the buildings as a group, and as a neighbourhood has enabled the monitoring of how developments from one building affected, or were limited by, others, as well as revealing something of the complex decisions involved in the planning, integration, and use of public and private space in the ancient city. Especially important in these aims has been the focus given to the development of a 'working-class' neighbourhood so that we might better understand the response of the Pompeian non-elite to the economic changes that swept across the Mediterranean between the second century BC and the first century AD.

The overall development of this corner of Pompeii can be briefly summarised, even if this is still only a preliminary outline. The earliest structural activity of this part of Pompeii is registered in the scattered remains of some wall foundations of local tufo blocks, the so-called '*pappamonte*'. These date to the fourth century BC but appear to have been short-lived, it seems, having preceded a period of a century or so of as yet unexplained abandonment in the area. Habitation did not resume until the mid-second century BC when the area was swept up in the city's 'Golden Age' of urban development. Industrial activities dominated the landscape of the neighbourhood from this period onwards, and all appear to have been at a small scale and to have taken place within small households – a veritable 'cottage industry'. The specific industrial activities that have been recognised to date have centred on salted-fish products, but the excavations have also uncovered the second tannery ever to be recorded at Pompeii.¹⁰ A massive change then swept across *every* building in the first years of the first century AD. Most of the industrial facilities were destroyed, new floors were laid over old, and new walls were built while old ones were demolished or re-decorated. This represents a replacement of structures for industrial activity by those related to commerce. Instead of small-scale factories, we now find

shops and eating establishments. This urban transformation was by no means equitable, for some families grew their economic portfolios – if still of a rather modest scale – while others were reduced. This wholesale transition from industrial to commercial activity for so many neighbouring properties probably reflects broader economic patterns across Pompeii and the region; indeed this is also the period of the greatest number of foreign imports to Pompeii, a development that will have been undoubtedly energised by the new economic opportunities of the early Principate.

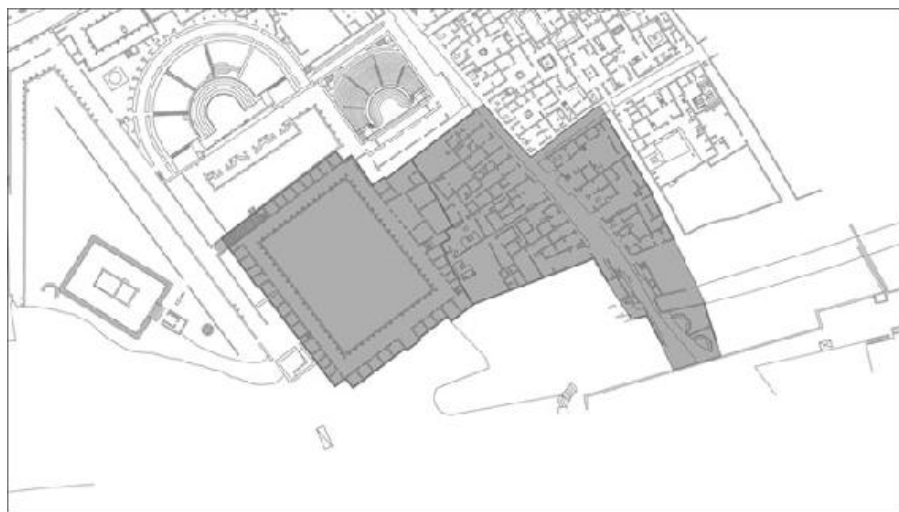


Figure 12.6 Plan of the southeast corner of Pompeii showing the location of the survey area. *Insula VII* occupies the central section of the area highlighted. Image: Eric Poehler.

Survey methods

The geophysical survey was conducted within *insula* VIII.7.1–15 in order to identify the location and depths of possible buried structures and features within individual rooms not yet explored by the PARP:PS project (Tucker 2009). The primary goal was to help guide future programmed excavation work and to aid in interpreting the development of this region, particularly in those areas where there has been no stratigraphic excavation.

The survey methodology had to be adapted to the limitations imposed by the standing walls which formed the latest buildings that were destroyed in AD 79. They subdivide the *insula* into a series of rooms, the largest of which was approximately 16.5m × 14m and the smallest 3m × 2m. Due to the spatial constraints and the presence of modern obstructions which would have caused interference with other techniques, GPR was selected as the optimal technique for this survey. The size and nature of the features revealed in the four previous years of excavation across the survey area indicated that GPR was likely to be successful in identifying archaeologically relevant anomalies, even within such small confined areas. A positive factor that emerged from the shape of the rooms was that the time needed for data collection would not

become prohibitive thus allowing for a short, targeted field season covering a large number of rooms.

Although the volcanic debris from the eruption in AD 79 has already been cleared in this part of the city, the depth of the urban stratified deposits above the natural hardened volcanic material still varies between 1.5m and 4m across the *insula*. Therefore, for this survey a Mala X3M 500MHz shielded antenna mounted on a rough terrain cart was selected as providing the ideal balance of resolution and depth-penetration. In order to maximize the area covered, data was collected parallel to the walls of the AD 79 structures in an x/y grid system in an attempt to ensure that features running parallel to either of the orientations of the traverses would be recorded in the other (Figure 12.7). The traverses were spaced 0.5m apart, due to the priority of collecting data in two directions to ensure the detection of parallel features, even at the cost of resolution. Although the use of the cart both increased the speed at which data could be collected and meant more variable terrain could be covered, one of the limitations of using this system was that data could not be collected flush with the walls of the rooms surveyed. A minimum of at least 0.25m was left for the passage of the wheels, and often the gap to any given wall was greater due to the orientation of the survey grids.



Figure 12.7 GPR survey underway at Pompeii.

The data was processed using GPR-Slice 6.0 to create a series of time-slices representing increasing time depths across the survey area. For this survey, the changes in topography were so minimal and the areas surveyed so small that topographic correction was not attempted. A reflected-wave “wall test”, as described by Conyers and Goodman (1997: 112–115), was conducted

and allowed for an estimate across the entire site as to the depth of each of the timeslices.

Results

In spite of frequent rainfall during data collection which can often prove problematic for GPR survey, twelve distinct rooms within the *insula* were surveyed, mostly in areas where prior excavation had ended at the AD 79 layers, occasionally overlapping with prior investigations by PARP:PS below this level. Where the survey overlapped with previously excavated areas the results were able to resolve many of the archaeological features, confirming that the technique was providing accurate data at the site and allowing for a preliminary estimate of the velocity of the signal.

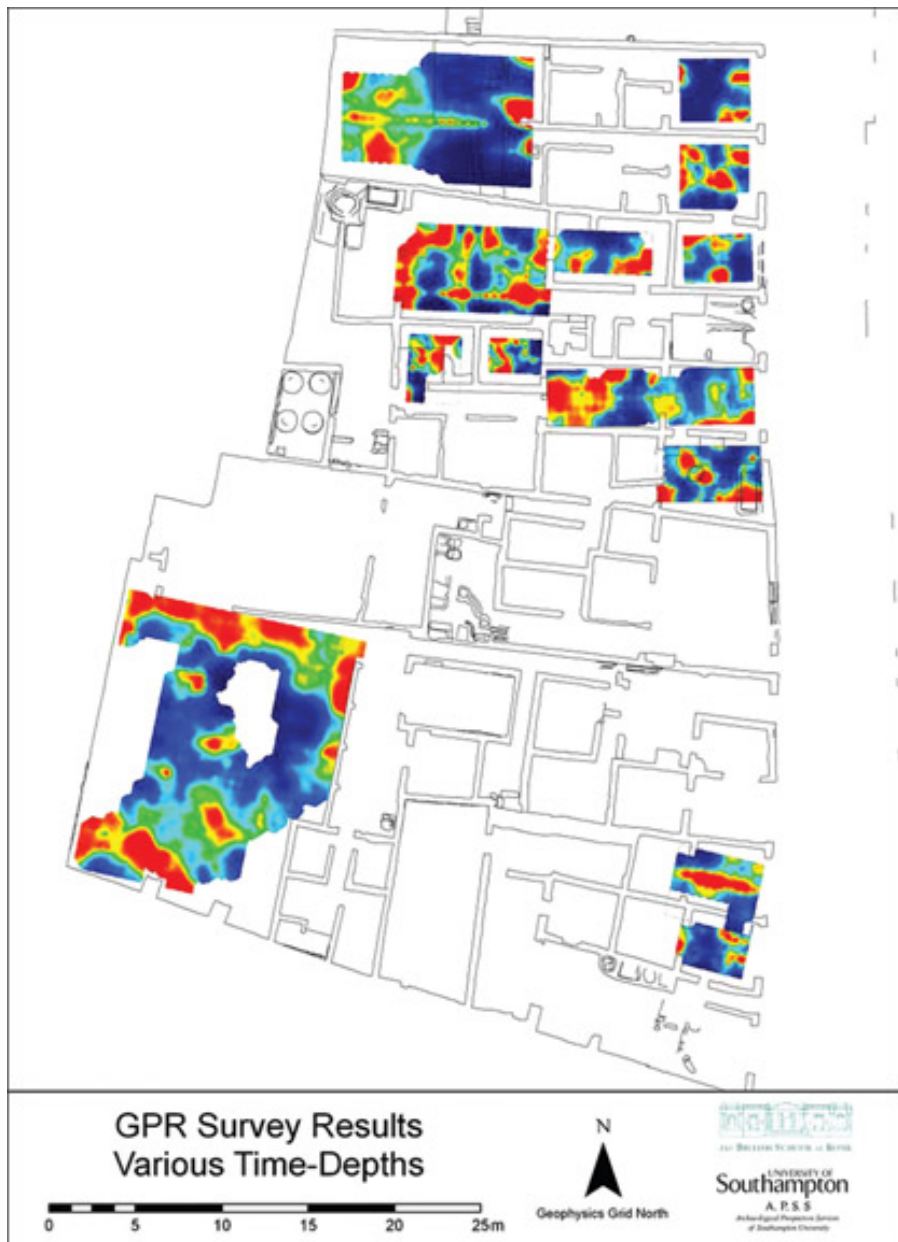


Figure 12.8 Plan of the insula VII building at Pompeii with the GPR time slice at various depths.

Over the unexplored areas, the GPR survey was also successful, identifying anomalies likely to be buried walls, tanks, and drains, in addition to broader anomalies that perhaps represent floor surfaces (Figure 12.8). These results appear to support a sequence of development throughout the *insula*, in which industrial phases, represented by the large tanks, preceded a change to more commercial functions and, occasionally, the movement of

property boundaries (Devore and Ellis 2005, 2008; Ellis and Devore 2006, 2007, 2008, 2009).

There were several specific instances where the GPR results and interpretation were subsequently confirmed by later excavations. One of these was a linear anomaly running directly towards the *Via Stabiana* which was interpreted as a drain, a conclusion reached by reviewing earlier excavation in nearby rooms and applying this information to the geophysical results (Figures 12.9a and 12.9b). In this instance the estimated depth of the drain proved to be accurate, in addition to its position within the room. In other areas the GPR data matched features that were subsequently revealed through excavation, and although the shape and depth of the anomalies was correct, in some instances the interpretation did not equate with that which was revealed by the excavation, therefore further emphasising the importance of dialogue between excavators and geophysicists. An example of this type of situation was the excavation of a discrete rocky fill that had been interpreted from the GPR data as a circular tank.

While the majority of the interpretations proved to be correct, there were some significant limitations encountered which, even though mitigated as discussed above, affected the quality of the results. It is commonplace to consider surface obstructions and interference in all geophysical survey work, and in the case of this *insula* the standing structures acted as the boundaries within which data could be collected. By surveying parallel to the walls and using an x/y grid, every effort was made to mitigate these factors, leading to positive results even given the extreme limitations of the site. Of course, surveying as close as possible to the standing structures would have been ideal, as would a higher resolution line-spacing which might have aided in the detection of smaller anomalies. Additionally, a more complete survey across the entire *insula* might allow for patterns to emerge and features to continue below walls and between rooms, providing a more complete picture of the development of the *insula* as a whole, as opposed to a series of individual rooms. This could perhaps further mitigate the limitations imposed by the standing masonry and facilitate a broader interpretation. Perhaps the most important improvement to future surveys will be to refine the interpretation of geophysical anomalies in the light of excavation results, which will in turn feed-back into a more holistic interpretation of the *insula* as a whole, and make it easier to frame future excavation and survey strategies.

Discussion

Although Herculaneum and Pompeii are amongst the two most famous archaeological sites in the world, recent research is showing that many questions about the nature and development of both towns remain to be answered.¹¹ The traditional archaeological approaches adopted by archaeologists have been, understandably, by means of analyses of standing buildings and through excavation. While these have substantially enhanced

our understanding of both towns in recent years, the abundance of surviving standing buildings and their often excellent state of preservation means that excavation often has to take place in confined spaces. This makes results difficult to interpret, as well as raising important conservational challenges when considering excavation within buildings that are often decorated with wall-plaster and mosaic floors. Furthermore, the sheer depth of overburden, as well as broader ethical issues, strongly discourages excavation of new areas within both towns.¹²

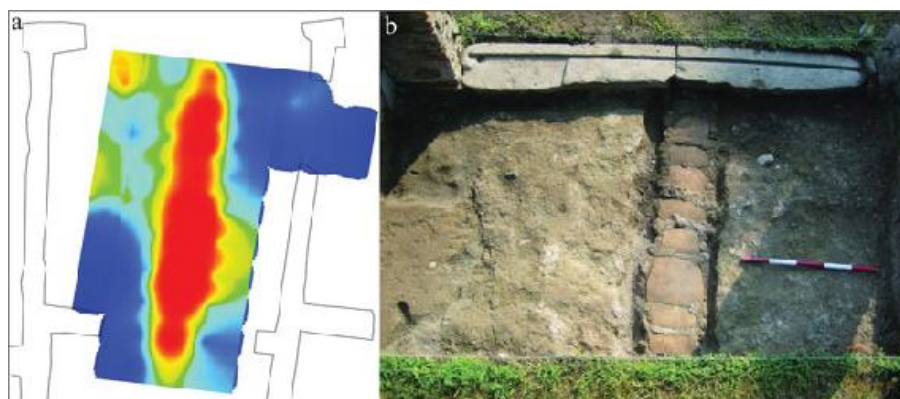


Figure 12.9 a) Detail of the Pompeii timeslice in Room 06 showing the major anomaly; b) the anomaly in Fig. 12.9a after excavation.

With the current emphasis on conservation and preservation, non-destructive geophysical survey methods are the obvious tool for large-scale investigation of archaeological sites, but yet their use is by no means widespread at either of the Vesuvian cities. The surveys discussed in this paper have made a positive contribution to our understanding of both towns, albeit at a very small scale. On the one hand, the GPR/ERT survey at Herculaneum demonstrated the potential for such surveys even working with highly disturbed volcanic deposits, and details of the complex of system of Bourbon tunnels and the layout of the Basilica itself were confirmed by subsequent trial excavation. It is important to note, however, that the best results came from using two different techniques, and that final results came from an interpretation that drew upon the strengths and weaknesses of both in the conditions offered by this particular site. Furthermore, the terrain corrective offered by topographical survey was also important. On the other, the GPR survey at Pompeii has helped the excavators better understand the overall plan of *insula* VIII.7. A second point is that in both cases these surveys have been undertaken as part of broader archaeological projects in which there has been a very fruitful exchange of data between geophysicists and excavators, which has been of considerable benefit to both and has enhanced overall understanding of both sites. In view of this, it is the contention of this paper that appropriately targeted geophysics has an

important role to play in our understanding of Herculaneum and Pompeii. For example, the targeted use of GPR prior to excavation could make a significant contribution to our understanding of the pre-Roman phases of Pompeii. It is also likely that the challenge of undertaking both of these surveys, particularly that at Herculaneum, will lead to advances in the development of new software and survey mechanisms for investigating deeply stratified sites.

Notes

- 1 This work was carried out in the context of the Herculaneum Conservation Project, a Packard Humanities Institute initiative (President David W. Packard) in collaboration with the *Soprintendenza Speciale per i Beni Archeologici di Napoli e Pompei* (Herculaneum Site Director Maria Paola Guidobaldi) and the British School at Rome (Director Christopher Smith). The project is directed by Andrew Wallace-Hadrill. The authors would like to thank all of these bodies for their help and assistance, as well as Sarah Court of the HCP.
- 2 With the generous consent of the *Soprintendenza Speciale per i Beni Archeologici di Napoli e Pompei*
- 3 <http://www.eastern-atlas.com>
- 4 <http://www.sfsu.edu/~pompeii/research2007.html>
- 5 For an overview of the Herculaneum Conservation Project, see the special edition of *Conservation and Management of Archaeological Sites* 8.4 (2007).
- 6 Cochin and Belicard 1751 (1971).
- 7 RDP (relative dielectric permittivity) is the measure of the ability of a material to store a charge from an applied electromagnetic field and then transmit that energy.” (Conyers 2004:45)
- 8 Publications include: Devore and Ellis 2005, 2008; Ellis and Devore 2006, 2008, 2009; Ellis *et al.* 2007; Ellis, Emmerson, Pavlick and Dicus Forthcoming; Ellis Forthcoming.
- 9 Our interests in the *Quadriporticus* have since led to the newly established ‘Pompeii Quadriporticus Project’ (co-directed by Eric Poehler and Steven Ellis).
- 10 On the tannery, see Devore and Ellis 2008: 8–11. On the salted fish products, see Ellis 2011, 59–88.
- 11 Dobbins and Foss 2007 provide a useful overview of recent work at Pompeii, and Wallace-Hadrill (2010) provides a summary of the understanding of Herculaneum
- 12 Wallace-Hadrill 2005; Wallace-Hadrill 2007.

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Suasa (Marche): metodologie di ricerca integrate per la ricostruzione storica della città

Marco Destro e Enrico Giorgi

Introduzione

Le ricerche del Dipartimento di Archeologia dell'Università di Bologna nella città romana di *Suasa* (Castelleone di Suasa, Ancona) (Figura 13.1), iniziate nel 1987 sotto la direzione di Pier Luigi Dall'Aglio e Sandro De Maria, sono state oggetto nel corso degli anni di numerosi studi, di carattere generale oppure su singoli aspetti, facendo di *Suasa* una delle realtà archeologiche meglio conosciute del settore medioadriatico. Contemporaneamente alle attività di scavo e di restauro attuate nel sito della città antica, sono stati promossi studi a carattere topografico sulla rete viaria, le divisioni agrarie e le modalità di insediamento, nonché numerose campagne di ricognizione nel territorio circostante che oggi hanno coperto pressoché per intero la valle del fiume Cesano.

Oggi, a più di venti anni dall'inizio delle ricerche, siamo in grado di ricostruire in maniera puntuale alcuni settori cittadini e di approfondire le fasi principali dello sviluppo urbano e dell'organizzazione territoriale.

Negli ultimi anni sono stati pubblicati alcuni studi di sintesi su *Suasa*, ed è fresco di stampa un importante volume che permette di fare il punto sulle conoscenze attuali e sulle principali novità emerse: a tali lavori faremo quindi riferimento nelle pagine che seguono¹.



Figura 13.1 Veduta aerea della città di Suasa (2003).

Scopo di questo lavoro, oltre a presentare le principali problematiche archeologiche e storiche emerse dal lavoro sul campo, è quello di fare il punto sull'utilizzo che a *Suasa* è stato fatto di tecnologie di indagine non invasiva, in particolare fotografia aerea e prospezioni geofisiche, a partire dalle prime applicazioni del 1987 – applicazioni per molti versi pionieristiche, che fecero dello scavo uno dei primi casi di utilizzo sistematico nell'area adriatica – fino agli ultimissimi sviluppi, per guardare poi alle prospettive di sviluppo per i prossimi anni. (M. D. – E. G.)

Metodologia: fotografia aerea e prospezioni geofisiche dalle prime applicazioni a oggi

Sin dalle prime ricerche condotte dall'Università di Bologna nell'area archeologica di *Suasa*, tra la fine degli anni Ottanta e i primi anni Novanta del secolo scorso, fu evidente come il sito fosse particolarmente adatto per l'applicazione di metodologie di indagine non invasive. Così, ad esempio, le prospezioni elettromagnetiche, condotte da Gianfranco Bruzzi nel 1987 a est della strada principale, furono preliminari agli scavi della *Domus* dei *Coiedii* e della Necropoli meridionale, mentre le fotografie aeree permisero di individuare e rilevare le tracce delle strutture del Foro prima ancora che iniziasse lo scavo estensivo dell'area². Sempre dall'analisi delle fotografie erano state segnalate anche le strutture dell'Edificio di Oceano. Il motivo di questa particolare rispondenza va cercato da un lato nelle caratteristiche stesse del suolo, dall'altro dal fatto che molti edifici si conservano interrati a pochi decimetri dall'attuale piano di campagna, tanto in profondità da non essere

stati troppo intaccati dall'aratro ma neppure troppo sotto terra, da risultare strumentalmente rilevabili o leggibili come tracce tipo *cropmark*³. Sulla scorta di queste esperienze, l'attenzione verso i metodi non invasivi di indagine archeologica non è mai venuta meno e anzi, a cadenza abbastanza regolare, si è sempre cercato di monitorare almeno l'area urbana. Per tenere bassi i costi della ricerca, si è cercato di sperimentare sistemi più economici di ripresa aerea (come nel caso delle fotografie da aquilone e da pallone aerostatico frenato) e di incentivare le collaborazioni con i colleghi e gli altri enti di ricerca e di tutela interessati⁴. In questo quadro si segnala, tra i risultati più recenti, la scoperta del Teatro (Figura 13.2) e dell'Edificio Suburbano, disegnati dalle tracce sull'erba grazie all'arida estate del 2003 e le tracce di infrastrutture e di elementi geomorfologici sepolti (strade, paleocanali, scarpate, paleoalvei), che sembrano emergere dopo gli ultimi rilievi geofisici integrati coordinati da Federica Boschi⁵.

Alle indagini non invasive è stata dedicata la terza edizione della Scuola Estiva (2009) di diagnostica per l'archeologia 'In profondità senza scavare' dell'Ateneo di Bologna, coordinata da chi scrive, che ha accolto studenti e docenti di ambito internazionale (Figura 13.3) ⁶. Quest'ultima fase del lavoro è la più recente e ha portato alla redazione di una planimetria integrata in formato digitale (GIS) che rappresenta il punto della situazione sull'attuale stato delle conoscenze. All'interno di questo disegno rientrano sia i rilievi aerofotografici, sia quelli geofisici, sia ovviamente i rilievi topografici di tutte le strutture note grazie allo scavo archeologico. Ne deriva una planimetria integrata, con la notazione critica della natura di ogni segno, che apre nuove possibilità di lettura della fisionomia urbana e che dovrebbe anche permettere di orientare al meglio i futuri progetti di ricerca, tutela e valorizzazione dell'area archeologica (Figura 13.4)⁷. Perciò questo palinsesto non vuole essere un punto di arrivo, ma piuttosto il punto di partenza di un sistema che speriamo di poter implementare nei prossimi anni. Allo stato attuale è in corso una revisione, condotta da Michele Silani, della documentazione aerofotografica e catastale conservata negli archivi storici⁸. Per il futuro si intende, inoltre, ampliare ancor più questo sistema di analisi al territorio circostante e ai suoi siti più notevoli⁹.

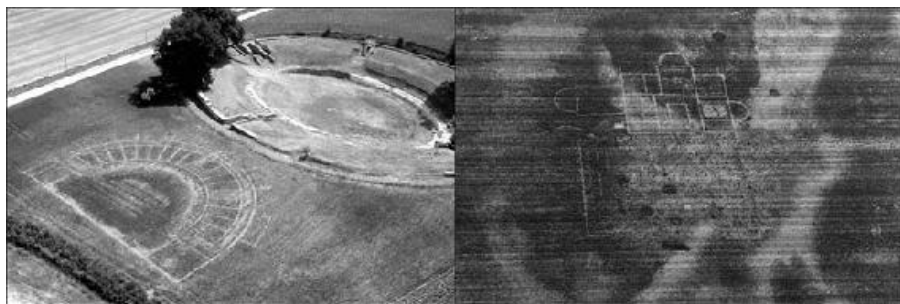


Figura 13.2 Le tracce del Teatro e di un Edificio Suburbano di età tardoantica individuate grazie alla fotografia aerea (2003).



Figura 13.3 Le tracce di edifici e stredade individuate grazie alla fotografia aerea da aquilone.

Tuttavia l'aspetto più interessante di questo lavoro deriva, naturalmente, dall'interpretazione archeologica dei segni individuati in base alle diverse metodologie¹⁰. Da questo punto di vista possiamo, se non altro a livello preliminare, evidenziare alcuni aspetti di particolare interesse.

Innanzitutto gli elementi geomorfologici sepolti fanno pensare a un paleosuolo antico molto meno regolare e pianeggiante rispetto a quello attuale, livellato dai continui lavori agricoli. Se poi si considera la geografia attuale del sito, unitamente a quanto si riscontra in base all'analisi geofisica, si può forse meglio delimitare l'area urbana suasana. Oltre al versante collinare a est e alla prima scarpata fluviale verso ovest, alcune tracce presenti a nord del Foro fanno ipotizzare un limite urbano che prosegue in quella direzione, andando a stringere verso la strada principale. Sul lato meridionale, invece, si nota una traccia abbastanza rettilinea che chiude dalla scarpata verso la collina, passando a cavallo della strada. Un'ipotesi di lavoro è che questo limite possa coincidere con l'andamento delle mura della città, che rappresentano proprio una delle lacune più significative nella conoscenza della forma urbana. Un altro elemento interessante potrebbe essere il paleocanale che potrebbe essere stato sfruttato come collettore urbano tra l'area delle abitazione e quella degli edifici per spettacolo. Questo spiegherebbe l'anomalo andamento delle canalette di scolo delle case, in contropendenza rispetto all'andamento naturale del terreno. Appena a sud della città si nota, infine, l'edificio suburbano che pare sorgere in corrispondenza di un antico dosso fluviale¹¹. Restano ancora da interpretare molte altre tracce particolarmente evidenti, come ad esempio quelle degli edifici visibili nell'angolo orientale e settentrionale dell'abitato. (E. G.)

Risultati: le principali problematiche storiche della città

Le attività di scavo e le indagini non invasive nell'area urbana e le ricerche topografiche nella valle del Cesano, portate avanti in maniera congiunta fin dai primi anni, danno oggi la possibilità di tracciare un quadro di sintesi sull'evoluzione della città e del suo territorio (Figura 13.5): accanto a molti problemi che rimangono ancora aperti, possiamo stabilire alcuni punti fermi nell'evoluzione storica di questo comprensorio, specie per quanto riguarda le fasi repubblicane e primo-imperiali. A tali risultati delle ricerche suase rimandiamo qui brevemente, rimandando alla bibliografia specifica per le descrizioni più dettagliate.

La nascita dell'abitato (III secolo a.C.)

La nascita di *Suasa* va posta nel quadro dei complessi avvenimenti storici che interessarono il settore medioadriatico nella prima metà del III secolo a.C. Come noto, le tappe fondamentali del processo di romanizzazione furono la battaglia di Sentino del 295 a.C., la fondazione della colonia romana di *Sena Gallica* (tra il 290 e il 283 a.C.), l'acquisizione di territori seguita alla conquista militare ad opera di Manio Curio Dentato (283 a.C.)¹², la fondazione della colonia latina di *Ariminum* (268 a.C.). Già da tempo è stato chiarito che l'iniziale forma amministrativa di *Suasa* deve essere stata quella di *praefectura*, in relazione alla *lex Flaminia de agro Gallico (et?) Piceno viritim dividundo* del 232 a.C.: la città sarebbe dunque sorta prima di questa data, e comunque prima dell'apertura della *Via Flaminia* (220 a.C.) dal momento che si dispone lungo un asse stradale più antico e non sul diverticolo della consolare che corre sul lato opposto della valle¹³. Oggi però sia in base a nuove considerazioni di carattere storico sia in seguito alle evidenze archeologiche, che mostrano fasi edilizie risalenti alla prima metà del III secolo, è possibile essere più precisi per la cronologia iniziale.

Le strutture edilizie riferibili a questo primo periodo di vita dell'abitato sono state rinvenute in particolare al di sotto della Casa del primo stile, una *domus* di II secolo a.C. conservatasi a sud della grande *Domus* dei *Coiedii* (cfr. *infra*): sotto due piani pavimentali posteriori sono emersi strutture murarie e stratigrafie datate sulla base di materiali alla prima metà del III secolo (Mazzeo Saracino 2004; Mazzeo Saracino 2007; Destro e Giorgi 2008: 92–94; Mazzeo Saracino 2010; Zaccaria 2010). Inoltre, anche al di sotto dell'Edificio di Oceano di età imperiale, in diversi saggi sono stati ritrovati materiali ceramici di pieno III secolo a.C., un piano pavimentale in cocciopesto della stessa epoca, nonché una fossa con deposizione intenzionale di materiale ceramico integro, tra cui un *thymiaterion* (Destro e Giorgi 2009: 213; Di Lorenzo e Giorgi 2010: 371–378). L'esiguità di tutti questi resti non permette di ricostruire planimetrie e funzioni dei vani individuati, ma si tratta comunque di una importante novità dal punto di vista storico. Anche nell'area del Foro sono stati intercettati livelli di III secolo, almeno in parte

riconducibili a strutture di carattere produttivo (Podini 2010: 239–240).

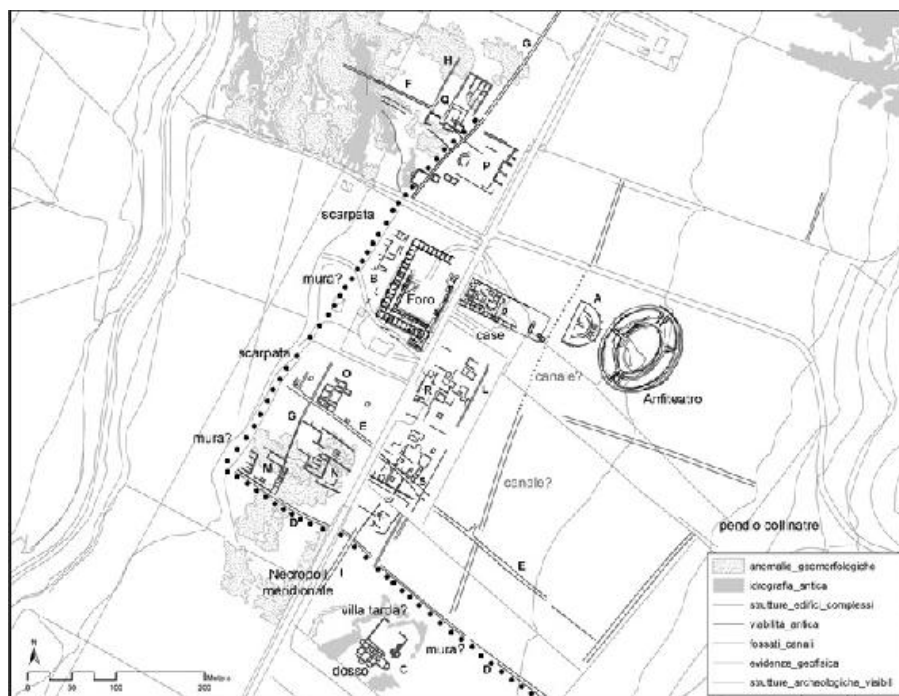


Figure 13.4 Planimetria integrata dell'area urbana (elaborazione F. Boschi).

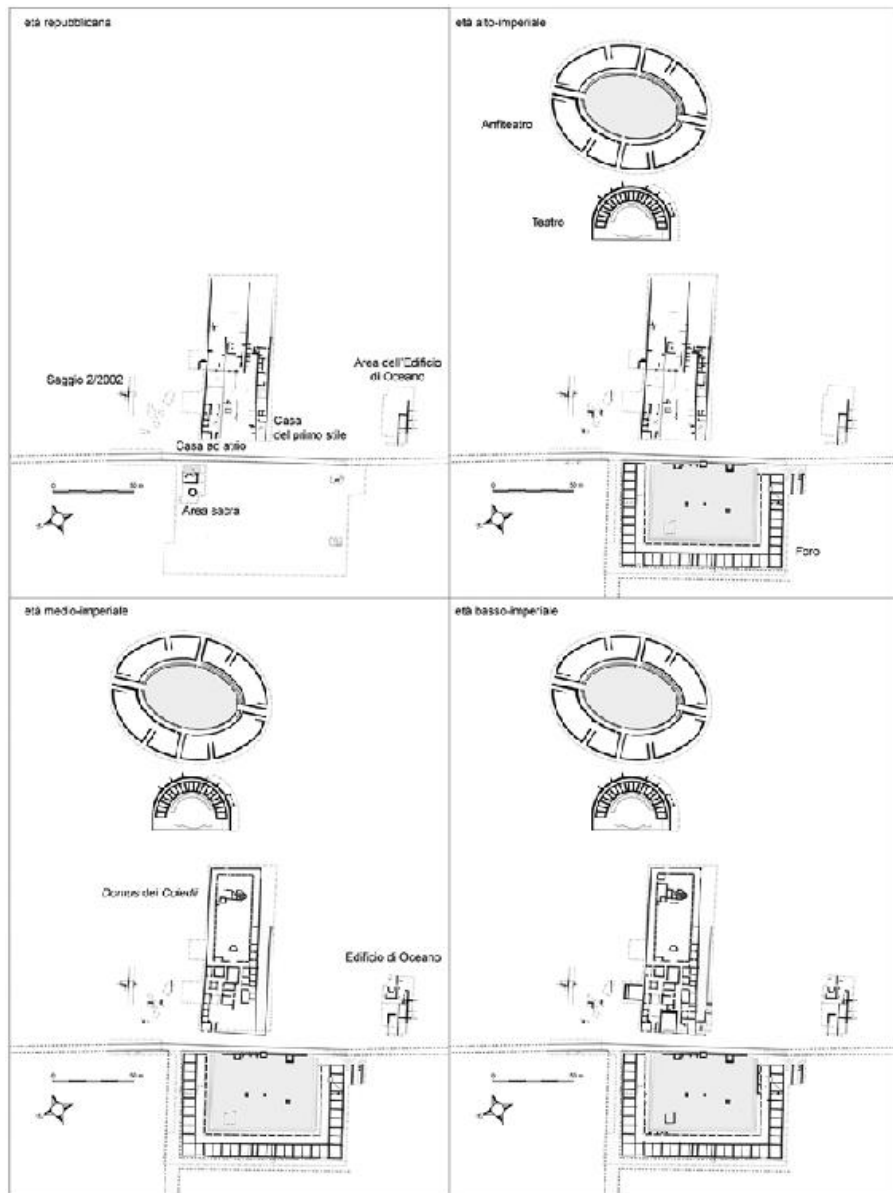


Figura 13.5 Le principali fasi edilizie (elaborazione M. Zaccaria).

In sintesi, l'abitato sarebbe sorto ben prima della fase della *praefectura*, forse sotto forma di *conciliabulum civium romanorum* in seguito alla fondazione di *Sena Gallica*: a questo primo nucleo si riferirebbero le stratigrafie e le poche strutture individuate, che appunto si datano alla prima metà del secolo. Si tratterebbe quindi di un modello di occupazione del territorio che accanto alla progressiva occupazione delle terre da parte di cittadini romani vide la nascita di nuclei abitati, talvolta vere città di fondazione (le colonie marittime), altre volte – e più spesso di quanto non si credesse fino a pochi anni fa – centri

abitati come *Suasa* meno strutturati dal punto di vista istituzionale e probabilmente urbanistico, che soltanto nei decenni successivi videro una rapida evoluzione verso forme propriamente urbane. Un esempio in qualche modo parallelo ma dagli esiti differenti è individuabile a *Pisaurum* (Campagnoli 2004), che nacque anch'essa come *conciliabulum*, ma poi venne fondata come colonia nel 184 a.C. insieme a *Potentia*.

Oggi dunque possiamo porre la nascita di *Suasa* negli anni immediatamente successivi alla fondazione di *Sena Gallica*, inizialmente con la funzione principale di supporto ai primi coloni insediati nelle terre da poco conquistate. Le ricerche future, storiche e archeologiche, chiariranno se queste ipotesi colgono nel segno.

Nell'area urbana non abbiamo tracce sicure di un abitato precedente, piceno o celtico¹⁴: sono piuttosto alcuni materiali a restituire qualche traccia della fase di passaggio tra il popolamento precedente e l'insediamento dei primi coloni romani. In questo senso, va segnalata la recente scoperta di un alfabetario latino in cui è stato proposto di riconoscere la mano di un Senone (Gaucci 2010).

Anche qui possiamo probabilmente verificare il fenomeno ben noto altrove che vide nella religione il punto di contatto tra popolazioni precedenti e nuovi arrivati: così come negli esempi meglio conosciuti di *Pisaurum*¹⁵ e di *Ariminum*¹⁶, anche nel nostro caso venne probabilmente attuata una *interpretatio* di culti preromani, in questo caso una divinità di nome *Suasa* attestata finora soltanto da rinvenimenti riminesi, secondo l'ipotesi di Marengo (2006).

Oltre all'aspetto propriamente cronologico, un'altra novità importante che viene dall'indagine archeologica delle fasi più antiche riguarda le forme della pianificazione iniziale: *Suasa*, proprio per le modalità della sua nascita, non è una città di fondazione, tuttavia le strutture più antiche ad oggi individuate si dispongono già secondo una sorta di pianificazione regolare, a maglia ortogonale, che ha il suo asse generatore nella strada che attraversa l'area urbana. Perpendicolarmente alla strada vennero infatti tracciate le divisioni tra gli isolati, sul lato orientale materializzate da lunghi muri divisorii, posti a 1/3 di *actus* e individuati durante gli scavi al di sotto della *Domus* dei *Coiedii*. L'originaria divisione in isolati venne poi sostanzialmente rispettata nei secoli successivi durante tutta la vita della città: la stessa *Domus* infatti si ingrandirà annettendo tre moduli iniziali, così come la Casa del primo stile posta immediatamente a sud occupa un isolato originario. Anche sul lato opposto, pur mancando le tracce di tali divisioni, si può facilmente notare che il Foro di I secolo d.C. si inserisce nella stessa maglia regolare.

Inoltre, con certezza a partire dal II secolo a.C., ma forse anche per il secolo precedente, è presente una distinzione tra il settore destinato all'edilizia privata – ad est della strada, verso la collina – e quello per l'edilizia pubblica – ad ovest della strada, verso il fiume – quest'ultimo con l'impianto in una primissima fase di strutture produttive, sostituite poi da un'area sacra.

Tutto questo, va ricordato, è stato finora individuato unicamente nel settore sottoposto ad indagine archeologica, corrispondente con ogni probabilità alla zona centrale di *Suasa*: non sappiamo se e in che misura questa programmazione iniziale e il suo mantenimento per tutta la vita della città siano da estendere al resto dell'area urbana, di cui al momento conosciamo ben poco e soltanto grazie ai risultati delle recenti indagini non invasive (cfr. *supra*, 'Metodologia').

In ogni caso, va sottolineata l'importanza l'aver individuato un sistema iniziale di organizzazione razionale dello spazio e di divisione dell'area abitata secondo moduli ortogonali risalente già alla fase premunicipale di pieno III secolo *Suasa*, in altre parole, poiché mostra una sorta di intervento regolatore fin dall'inizio, appare un abitato molto meno 'spontaneo' e 'casuale' di quanto normalmente non si pensi per centri di questo tipo. La scoperta si pone, a nostro parere, come una delle principali novità portate dallo scavo suasano e potrà fornire indicazioni anche per i numerosi altri casi di città nate come *conciliabula* o *fora*, il cui aspetto originario spesso non è noto¹⁷.

L'età repubblicana (fine III–fine I secolo a.C.)

Alla fine del III secolo e soprattutto nel II secolo a.C., la città appare già più strutturata, con una marcata differenziazione degli spazi e con strutture edilizie, sia pubbliche che private, di buon livello. Rispetto alla fase precedente, gli edifici di questa fase si sono conservati in buono stato, così da poter essere indagati nel dettaglio.

Tra le maggiori novità degli ultimi anni di scavi ricordiamo la scoperta di un'area sacra tardorepubblicana: al di sotto del settore nord-orientale dell'area del Foro sono venuti in luce un tempio circolare su podio, probabilmente un *monopteros*, di cui resta il nucleo interno della cella in cementizio (con le tracce dell'originario rivestimento in blocchi di calcare) e della scala di accesso, e accanto di un tempio rettangolare, di cui restano *in situ* la decorazione modanata della facciata e parte dell'intonaco esterno; entrambi gli edifici sono rivolti a sud ed orientati parallelamente alla principale strada cittadina (Figura 13.6)¹⁸. L'area sacra, il cui scavo è tuttora in corso, comprende anche due basi di altari antistanti, uno rettangolare e l'altro cilindrico, cui si appoggiano ancora i resti carbonizzati degli ultimi sacrifici compiuti. In base alle considerazioni stratigrafiche preliminari, la cronologia dei templi è da fissare tra la fine del II e la prima metà del I secolo a.C. Nei decenni successivi, ma sempre entro il I secolo a.C., immediatamente ad est, verso la strada, venne costruito un altro edificio con pavimentazione a rombetti fittili, la cui pianta non è ricostruibile perché tagliato dalle fondazioni del Foro, ma che in via di ipotesi può essere ricostruito come un vano porticato collegato all'area sacra. Probabilmente proviene da questo vano lo scarico di intonaci parietali rinvenuto poco lontano, contenente frammenti con decorazione di tardo secondo stile o terzo stile iniziale, della prima età

augustea. Va segnalato un piccolo frammento con lettere greche dipinte, di recente identificate come parte di un epigramma di Leonida di Taranto compreso nell'*Antologia Palatina* (*Anth. Gr.* VI, 110): il rinvenimento getta una luce inattesa sulla vivacità culturale e sulla diffusione della lingua greca nella *Suasa* dell'epoca (De Maria 2010: 31–32; Griesi 2010; Lepore 2010).

A sud della *Domus* dei *Coiedii* di età imperiale si estende la c.d. Casa del primo stile (De Maria 2010: 22–23; Zaccaria 2010; Mazzeo Saracino 2010), una casa ad atrio del pieno II secolo a.C., caratterizzata da uno sviluppo marcatamente longitudinale ed uno stretto affaccio sulla strada. Il motivo per il quale una casa così antica si è conservata sostanzialmente intatta – a parte il settore d'ingresso che venne occupato da una costruzione molto più tarda – è che nel II secolo d.C. i nuovi proprietari della vicina grande *Domus* decisero di mantenere non edificata una fascia a sud della loro grande dimora e reinterrare quindi l'abitazione precedente che qui si trovava. A questa decisione dobbiamo il fortunato caso che oggi permette lo scavo di strutture non disturbate e modificate da interventi successivi. La Casa – che come si è visto a sua volta è preceduta da strutture del secolo precedente – rappresenta un esempio di abitazione modesta e dalla planimetria molto semplice, ma dotata di decorazioni pavimentali e parietali di buon livello, paragonabili agli esempi coevi dell'area tirrenica.

Anche se si imposta su strutture del secolo precedente, delle quali però ci sfugge la fisionomia complessiva, risale alla metà circa del I secolo a.C. il nucleo originario della *Domus* dei *Coiedii*: si trattava in questa fase di una casa ad atrio tuscanico con uno schema abbastanza canonico (Campagnoli 2010: 322–324). Le profonde trasformazioni attuate nelle fasi successive rendono possibile oggi soltanto affermare che anche in aree vicine vi erano in questo periodo altre abitazioni nonché alcuni impianti produttivi.

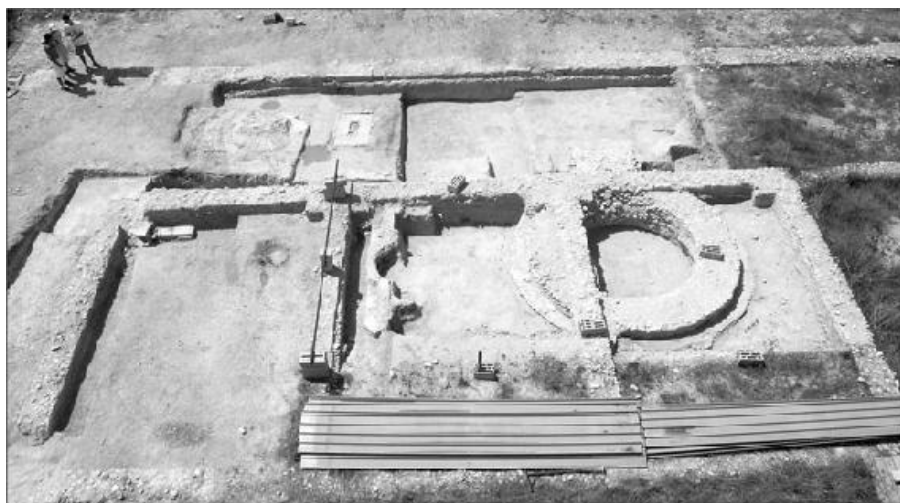


Figura 13.6 Veduta dell'area sacra repubblicana sottostante il Foro in corso di scavo.

L'età imperiale

Analogamente a quanto avviene in molte altre città italiane, è durante la prima età imperiale che *Suasa* si struttura definitivamente secondo linee programmatiche che si manterranno, pur con alcune modifiche, anche nei secoli successivi. All'età di Tiberio è da datare la costruzione del Foro commerciale, una grande struttura composta da una piazza rettangolare circondata da tre bracci di portico, su cui si affacciava una serie di vani regolari, perlopiù da interpretare come botteghe o laboratori artigianali (De Maria e Paci 2008: 645–649; Destro e Giorgi 2008: 84–91; Destro 2010b) (Figura 13.7). La perdita dei piani d'uso, dovuta al limitato interro, non permette quasi mai di identificare la funzione di ogni singolo vano. Lo scavo di questo grande complesso è ormai pressoché concluso – con l'eccezione del settore d'ingresso, parzialmente coperto dalla strada moderna – e a livello generale è fuori di dubbio il carattere principalmente commerciale della struttura. Rimane quindi aperto il problema dell'ubicazione delle strutture civili e religiose che dovevano caratterizzare la città: con la possibile eccezione del settore centrale del lato lungo, dove è possibile in via ipotetica porre un edificio di maggiore impegno, forse un tempio, non vi sono infatti tracce né della basilica né della curia o di altri edifici civili e religiosi. L'ipotesi è quindi che il foro vero e proprio sia da ricercare altrove, con maggiori probabilità sempre ad ovest della strada a sud – forse nell'area oggi occupata dalla cosiddetta 'casa del Tappatino' – oppure a nord, dove le recenti indagini geofisiche e riprese aereofotografiche hanno rivelato la presenza di edifici di grandi dimensioni (cfr. Figura 13.4). Si tratta per ora solo di ipotesi di lavoro che andranno verificate nei prossimi anni¹⁹.

Tra la fine del I secolo a.C. e l'inizio del I d.C. vennero costruiti anche gli edifici per spettacolo. L'Anfiteatro è uno dei più grandi delle Marche, dopo Ancona, tra quelli conosciuti; lo scavo, condotto dalla Soprintendenza per i Beni Archeologici delle Marche sotto la direzione di Paolo Quiri, ha riportato in luce gran parte della struttura, il cui perimetro è stato l'unico elemento della città antica rimasto sempre visibile nel corso dei secoli (Quiri 2010).

Come da tempo ipotizzato, le dimensioni del Foro commerciale, così come quelle dell'Anfiteatro appaiono sovradimensionate rispetto alla grandezza della città. La spiegazione va cercata nel fitto popolamento rurale, del resto verificato nelle ricognizioni di superficie effettuate: se la città è relativamente piccola, il suo territorio doveva essere fittamente popolato, e quindi la popolazione che faceva uso di questi edifici pubblici doveva essere numerosa.

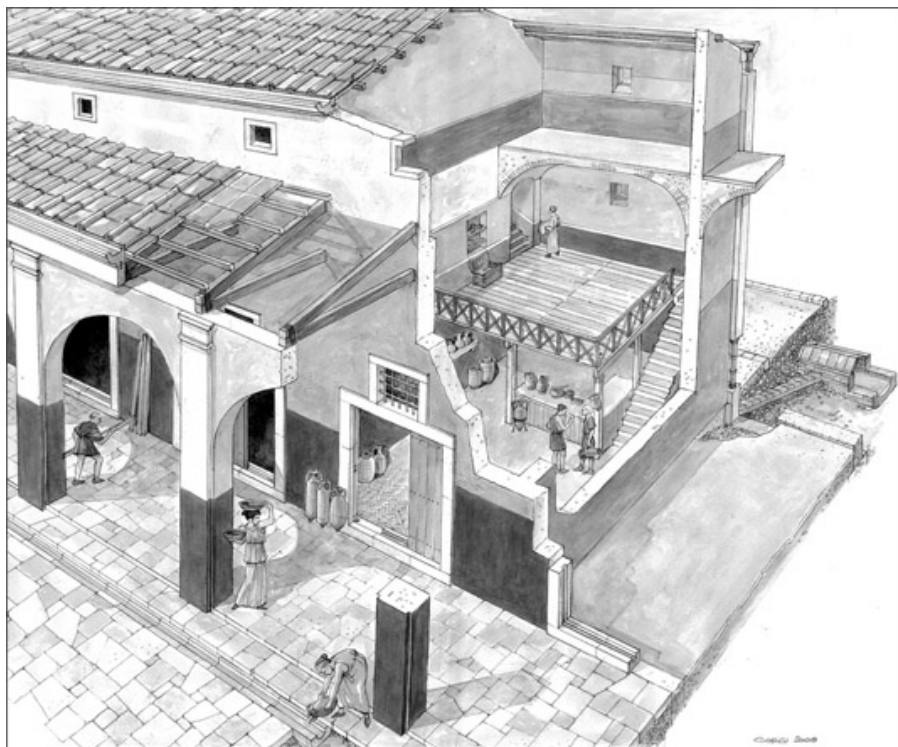


Figura 13.7 Ricostruzione di una delle botteghe del Foro di età imperiale (disegno di G. Giorgi).

Nel 2003, condizioni climatiche particolarmente favorevoli hanno permesso l'individuazione tramite fotografia aerea del Teatro, di cui non si aveva fino a quel momento alcuna conoscenza: le tracce visibili dall'alto tramite aquilone e pallone aereostatico frenato sono state talmente precise da permettere un rilievo fotogrammetrico di dettaglio dell'intera struttura²⁰. L'anno seguente è stato aperto un saggio di scavo per verificare lo stato di conservazione, che è risultato abbastanza scarso, con la perdita dei piani pavimentali e ampie spoliazioni della *cavea*. In base ai risultati di questo saggio, si può al momento ipotizzare che il Teatro sia stato costruito nel I secolo d.C. ed interessato da un ampliamento nel corso del III secolo: il diametro della *cavea* è di cinquanta metri circa, mentre l'ampliamento esterno è largo circa tre metri (Destro e Giorgi 2008: 83–84; 2009: 213–214; Giorgi 2010c). Va sottolineato che anche questo edificio si inserisce nell'organizzazione razionale dello spazio urbano cui si è fatto riferimento sopra.

Il complesso più noto e meglio conservato della città è la grande *domus* dei *Coiedii*, una ricca residenza privata nata nel II secolo d.C. accorpando diversi lotti precedenti, per una estensione totale che supera i 3000 mq. La sontuosità della casa rimanda certamente ad una delle famiglie più ricche di *Suasa*, in grado di commissionare decorazioni pavimentali e parietali di

ottimo livello (Figura 13.8). La *Domus* è oggi scavata quasi interamente, con l'eccezione del settore d'ingresso ad ovest che sarà possibile indagare compiutamente in occasione della rimozione della strada moderna. Le ricerche degli ultimi anni hanno permesso di aggiungere nuovi importanti dati riguardo all'area del giardino, che vide tra l'altro l'impianto di un settore termale autonomo dal resto della casa nella seconda metà del II secolo, modificato parzialmente nel secolo successivo (Bogdani e Giorgi 2010).

In base ad alcune anomalie evidenti nelle fotografie aeree, tra il 2002 e il 2006 è stato indagato parzialmente un edificio posto ad est al 'Tappatino', la casa cinquecentesca che ospita i laboratori di scavo. L'indagine ha permesso di individuare un articolato complesso, dotato anche di bei pavimenti musivi, ben conservati nonostante il limitatissimo interro: dal motivo di uno di essi è stato desunto il nome convenzionale di Edificio di Oceano²¹. L'area appare caratterizzata da un ampio settore termale, costruito nel I secolo a.C. e ristrutturato nel II d.C. con l'aggiunta dei mosaici figurati. Lo scavo non ha raggiunto i limiti dell'edificio, e non è ancora chiaro se si tratti dell'area termale di una casa privata, o piuttosto delle terme pubbliche cittadine.

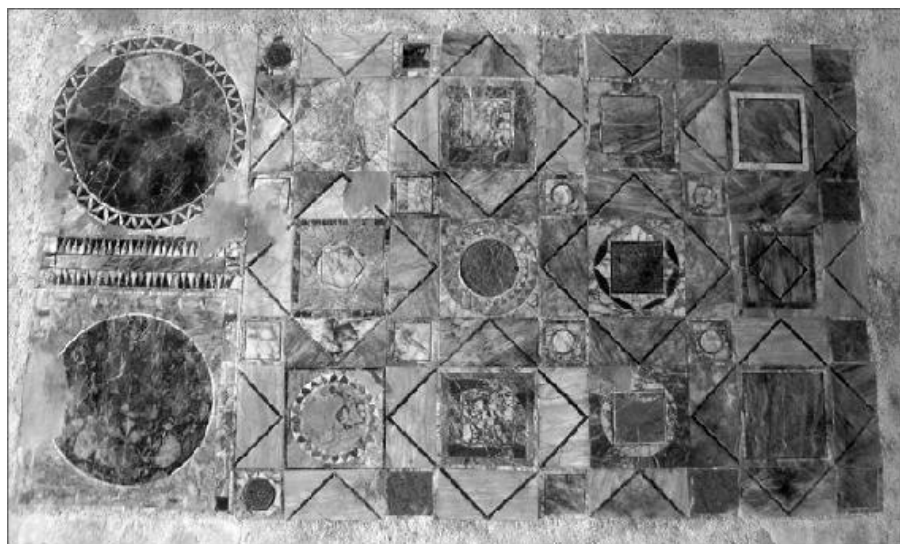


Figura 13.8 Pavimentazione in opus sectile dalla Domus dei Coiedii.

L'età tardoantica e la fine della città

Gli edifici di età imperiale videro trasformazioni parziali nel III secolo che nel complesso modificarono alcuni singoli aspetti ma senza cambiare decisamente la fisionomia cittadina (Destro 2010a).

Ad esempio, nella *Domus dei Coiedii* venne creato un *hospitium* e venne alienato un settore lungo la strada per edificare un edificio a sé stante, probabilmente la sede di un *collegium*, analogo a quanto avvenne pochi metri più a sud sui livelli, da tempo interrati, della Casa del primo stile

repubblicana. Parziali ristrutturazioni si notano anche altrove, nell'Edificio di Oceano, così come dotazioni monumentali nel Foro con una dedica a Caracalla e verosimilmente una dedica a Silvano, legata ad una corporazione di commercianti di legname secondo l'interpretazione di Gianfranco Paci (De Maria e Paci 2008).

Diversa è la situazione nel IV secolo, quando gli interventi sugli edifici esistenti si limitano perlopiù a restauri di modesto livello, segno di una diminuita capacità economica; iniziano poi fenomeni di abbandono o almeno defunzionalizzazione di alcuni settori, ben visibili nella grande *Domus*. Pur nella difficoltà di seguire le trasformazioni nel tempo vista la perdita dei piani d'uso, anche nel Foro in secolo almeno una parte del complesso mostra segni difficoltà, in particolare nel mantenimento del sistema di smaltimento delle acque. Anche nella piazza alcuni interventi minori, come la costruzione di una sorta di labile recinto a ridosso del portico ovest, sembrano indicare un progressivo decadimento, che del resto è in linea con l'evoluzione dei *fora* delle città romane tra IV e V secolo.

Nel campo dell'edilizia privata, un segno di carattere ben diverso è dato invece dalla costruzione della grande villa suburbana individuata nel 2003 grazie alla fotografia aerea e non ancora oggetto di scavo.

Il V secolo vide al contrario mutamenti notevoli, che spesso assunsero la forma di rottura rispetto alle fasi precedenti nelle modalità di utilizzo degli edifici esistenti: è questo il caso dell'area del giardino della *Domus* dei *Coiedii* dove è stato scavato un vasto sepolcreto con tre fasi d'uso ben riconoscibili. Parte del resto della casa continuò ad essere abitata ma con forme sempre più degradate e povere, mentre altri settori erano già abbandonati. Il secolo si chiude con un quadro di deciso impoverimento e di trasformazioni profonde dell'abitato, secondo le linee generali del periodo.

Ancora non del tutto verificata per via archeologica è la datazione dell'abbandono della città, che va posto tra fine VI e VII secolo sulla base anche di considerazioni generali. Di certo possiamo escludere una fine traumatica, dovuta ad eventi esterni (bellici o altro): *Suasa* venne gradualmente abbandonata dai suoi abitanti che per varie ragioni – sicurezza, ma anche la probabile difficoltà a mantenere un assetto idraulico ottimale – ritennero preferibile spostarsi in uno o più centri di crinale²². I resti della città antica continuarono ad essere occasionalmente frequentati, specie quelli lungo la strada principale, che rimase sempre percorribile, e divennero una cava di materiale edilizio, come provano i numerosi reimpieghi individuati nella valle del Cesano e le sette calcare scavate nel Foro. (M. D.)

Conclusioni

L'utilizzo congiunto di ricerca topografica, scavo archeologico e metodi di indagine non invasiva, ha come si è visto, una storia ormai lunga a *Suasa*, più che ventennale. I risultati appaiono certamente positivi, dal momento che ogni

tipo di studio ha permesso di apportare nuovi dati al quadro storico generale. Nell'immediato futuro, ci aspettiamo ulteriori progressi grazie ad un nuovo impulso dato alle ricerche geofisiche e allo studio delle fotografie aeree, al fine di gettare nuova luce sui problemi ancora aperti dell'urbanistica suasana: a titolo di esempio, la posizione delle mura, l'ubicazione delle strutture civili (un secondo foro?), l'estensione di aree residenziali o produttive suburbane, l'estensione delle necropoli, specie quella settentrionale ancora poco conosciuta²³.

Notes

- 1 Le più recenti sintesi, su alcuni aspetti o complessive, sono: Dall'Aglione, De Maria e Podini 2007; Dall'Aglione 2008; De Maria 2009; De Maria e Paci 2008; Destro e Giorgi 2008; Destro e Giorgi 2009; per un quadro analitico aggiornato si veda ora il volume Giorgi e Lepore 2010.
- 2 Da questo punto di vista occorre segnalare la particolare sensibilità nei confronti delle moderne tecnologie applicate all'archeologia che ha sempre caratterizzato il progetto suasano, soprattutto grazie a Pier Luigi Dall'Aglione, oltre che a Sandro De Maria.
- 3 Il discorso, ad una scala differente, è però valido anche per gli elementi geomorfologici sepolti. I paleoalvei, ad esempio, sono tra le tracce di maggiore evidenza.
- 4 Si ricordano in particolare la Soprintendenza per i Beni Archeologici delle Marche, il Comando Carabinieri Tutela del Patrimonio Culturale, la Fondazione Flaminia di Ravenna, il TEMPLA del Dipartimento di Archeologia di Bologna, il DICAM (già DISTART) dell'Università di Bologna, il DIMeC dell'Università di Modena e Reggio Emilia.
- 5 In questo caso sono stati utilizzati numerosi strumenti operando nel campo sia della magnetometria, sia delle prospezioni elettriche ed elettromagnetiche. Per quanto riguarda la tipologia degli strumenti utilizzati si rimanda a Boschi 2010. Il Dipartimento di Archeologia di Bologna utilizza con particolare intensità ed efficacia, grazie alla Fondazione Flaminia di Ravenna, un Magnetometro-gradiometro al potassio GEM System GSMP-35. Si tratta di un'apparecchiatura di elevata sensibilità (risoluzione: 0.0001 nT; accuratezza: ± 0.1 nT) che permette di effettuare un numero di misure al secondo superiore a quella delle altre classi di magnetometri attualmente presenti sul mercato.
- 6 Solo per quanto riguarda la geofisica applicata all'archeologia, ricordiamo: Larry Conyers (Università di Denver, Colorado, U.S.A.), Michel Dabas (Geocarta, Parigi, Francia), Helmut Becker (Becker Archaeological Prospection, Beuerberg, Germania), Marco Bittelli, Federica Boschi (Università di Bologna), Marta Bottacchi, Stefano Campana, Fabio Mantovani (Università di Siena). Per quanto riguarda gli altri docenti e più in generale riguardo ai metodi applicati nel corso delle varie edizioni della scuola si rimanda a Giorgi 2009.
- 7 La planimetria integrata distingue con colori diversi i disegni derivanti da fonti differenti (topografia, geofisica, aerofotografia) ma distingue anche le anomalie in base alla loro interpretazione (elementi geomorfologici o archeologici). Per una descrizione più completa si rimanda a Boschi 2010.
- 8 L'obiettivo è quello di integrare questa preziosa documentazione storica nel GIS, georeferenziandola.
- 9 Il Dipartimento di Archeologia di Bologna, in sinergia con la Soprintendenza per i Beni Archeologici delle Marche, ha elaborato già una Carta Archeologica della Valle del Cesano e porta avanti ogni anno campagne di monitoraggio e di ricognizione sul territorio. Si veda da ultimo Dall'Aglione 2010, con bibliografia relativa.
- 10 Trattandosi di un lavoro in corso, spesso ancora da sottoporre alla verifica dei sondaggi

- archeologici, si avanzano per ora solo ipotesi che dovranno essere confermate o confutate. Tuttavia ritengo che l'aspetto più innovativo dell'archeologia non invasiva o preventiva derivi, più che dall'applicazione di questa o quella metodologia, dall'interpretazione che se ne può dare sul piano archeologico, urbanistico, storico-topografico. Questo è di solito possibile nel migliore dei modi solo grazie alla proficua collaborazione tra competenza diverse.
- 11 Se, come sembra per ora solo dalla planimetria e dalla topografia, l'edificio è interpretabile come villa extra-urbana di epoca tarda, la sua collocazione su un rialzo morfologico, al riparo da eventuali ristagni d'acqua, sarebbe particolarmente significativa.
 - 12 Giorgi 2010b: 57, con bibliografia precedente, tra cui segnaliamo in particolare Bandelli 2002.
 - 13 La strada sulla destra del fiume, che costituisce l'asse generatore della città, è in relazione con le percorrenze che provengono dall'area di Sassoferrato. Per il rapporto tra il sito della città e la viabilità si veda Dall'Aglia 2008.
 - 14 Le campagne di ricognizione hanno individuato diversi siti della tarda età del Ferro, ma non un vero centro egemone nella media valle del Cesano. Un sito di una certa rilevanza nelle vicinanze della città romana è quello di Miralbello, posto di fronte a *Suasa* sulla sponda opposta del fiume su un alto pianoro interessato da una lunga continuità abitativa che dalla Protostoria giunge all'età romana e continua nel Medioevo con una torre ancora parzialmente visibile.
 - 15 Il riferimento è al celebre *Lucus Pisauensis*, per il quale si vedano Campagnoli 2004: 28–30 e Di Luca 2004, con bibliografia precedente.
 - 16 Ortalli 2006 e da ultimi Cicala 2008 e Malnati 2008, anche per le nuove testimonianze da Cattolica.
 - 17 La scarsa conoscenza dell'aspetto originario di questo tipo di abitati è evidenziata anche negli studi generali di urbanistica romana: cfr. ad esempio Gros e Torelli 1994: 128; cfr. anche, per l'*ager Gallicus*, Bandelli 2002: 79. Si veda anche Villicich 2007 per il tema più specifico delle aree forensi negli abitati minori della Cisalpina. Si vedano a questo proposito le considerazioni di Ortalli 2006 per il caso di Rimini.
 - 18 De Maria e Paci 2008: 649–651; Destro e Giorgi 2008: 85–86; Podini 2010. Durante gli scavi dell'estate 2010 sono state rinvenute le fondazioni interne della cella del tempio rettangolare.
 - 19 In caso di presenza del foro civile in un'altra posizione, andrebbe riconsiderata la questione del 'centro nevralgico' della città, che oggi appare segnato dalla presenza del Foro commerciale, della grande *Domus* dei *Coiedii* e dall'incrocio con la strada che portava al Teatro e all'Anfiteatro, grossomodo ricalcata da una via moderna.
 - 20 Le tracce rimasero visibili soltanto per pochi giorni nell'estate del 2003, grazie ad un periodo di grande siccità e alla coltivazione ad erba medica del campo. Per i dettagli delle operazioni di rilievo, effettuate in collaborazione con il DISTART della Facoltà di Ingegneria dell'Università di Bologna, si veda ora Bitelli e Vittuari 2010, con bibliografia precedente.
 - 21 Destro e Giorgi 2009: 211–213; Di Lorenzo e Giorgi 2010. Ora l'area è stata reinterrata e non è più visibile.
 - 22 Per l'analisi dell'abbandono delle città romane nelle Marche settentrionali rimando a Destro 2004.
 - 23 Per una sintesi delle conoscenze sulle necropoli si vedano Giorgi 2010d; Giannotti 2010a e 2010b.

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Nuove indagini integrate a Classe (Ravenna). Stato attuale e prospettive di ricerca

F. Boschi

Introduzione

Classe è una località posta 5km a sud di Ravenna. La storia del sito inizia in età romana, quando l'imperatore Augusto stabilisce a Ravenna una sede della flotta militare destinata al controllo del mare Adriatico.

Dagli inizi del V sec., in concomitanza con l'ascesa di Ravenna a nuova capitale dell'impero d'Occidente, Classe si sviluppa come città-satellite vera e propria, dotandosi di mura e di importanti monumenti, in un'area precedentemente occupata da necropoli ed edifici suburbani. La sua fase più vitale si colloca dunque tra V e VII sec., quando vengono costruite le grandi basiliche cristiane e il centro assume funzioni ben definite: la città viene dotata di un porto commerciale, con numerosi magazzini, impianti di produzione, strade e altre infrastrutture, che si afferma ben presto tra i più importanti dell'intero Mediterraneo (Figura 14.1).

Dal 2001 il Dipartimento di Archeologia dell'Università di Bologna conduce nel sito indagini sistematiche. Parallelamente agli scavi intrapresi nella zona del quartiere portuale, nel sito della basilica di San Severo e, più di recente, presso la basilica Petriana, l'ottica territoriale delle nuove ricerche si è concretizzata anche nella realizzazione della *Carta del Potenziale Archeologico di Classe*, un progetto intrapreso in sinergia con la Soprintendenza per i Beni Archeologici dell'Emilia Romagna, la Fondazione RavennAntica Parco Archeologico di Classe e il Comune di Ravenna, al fine di supportare al meglio sia la conservazione e valorizzazione dell'area archeologica, sia la pianificazione urbanistica del territorio a sud di Ravenna.¹

Stato dell'arte

E' ormai stato ampiamente dimostrato come le indagini geofisiche possano aggiungere informazioni anche molto significative ai siti documentati da fotografia aerea. Recenti lavori condotti nei siti di West Heslerton nell'Inghilterra settentrionale (Powlesand 2001; 2006), di *Carnuntum* in Austria (Doneus e Neubauer 1998; 2005), di Ruffenhofen in Germania

(Becker 2001) o, in Italia, di *Portus* nella valle del Tevere (Keay *et al.* 2005; Hay *et al.* 2006), di *Potentia* (Potenza) (Vermeulen e Verhoeven 2004; Percossi, Pignocchi e Vermeulen 2006) e di Aiali in provincia di Grosseto (Campana 2005; Campana *et al.* 2006), hanno dimostrato come l'integrazione di prospezioni geofisiche e aeree con altri dati possa arricchire l'interpretazione delle strutture archeologiche fornendo contemporaneamente positive implicazioni metodologiche.

Tra le nuove esperienze maturate a Classe vi è anche l'utilizzo di alcune tecniche di indagine geofisica, mediante le quali si è tentato di ampliare le informazioni ricavate dall'analisi storico-topografica del sito e dalle immagini tele rilevate, avviata in maniera sistematica a partire dal 2005. Rispetto a molti dei casi di studio indicati in precedenza, Classe rappresenta però un caso difficile, tanto da poter rientrare a pieno titolo nella recente definizione di scuola anglosassone di *clay and difficult soils landscapes* (Mills e Palmer 2007). La 'difficoltà' di questi terreni è per lo più legata alla problematica visibilità dei cropmarks, dovuta alla diffusa presenza di argilla e di zone arabili, con suoli profondi e caratterizzati da una particolare tendenza a trattenere l'umidità (Evans 2007). A complicare ulteriormente la situazione è il dato ricavabile dalle ultime ricerche sul deposito archeologico del territorio di Classe, dove i resti archeologici noti, per lo più inquadrabili tra l'età romana e l'età medievale, giacciono a profondità comprese tra 0.40 e oltre 5m (Augenti 2011). Ne deriva che nei settori caratterizzati da spessi riporti alluvionali o da stratificazioni complesse l'utilizzo di tecniche del remote sensing può tradursi in un sostanziale insuccesso o, quanto meno, restituire dati di non facile interpretazione. Per tali motivi, la strategia di ricerca da perseguire con determinazione nel caso di Classe è la sistematica integrazione tra fonti, metodologie e strumentazioni differenti. Soltanto in questo modo sarà possibile ottenere informazioni attendibili sul record archeologico sepolto e superare i forti limiti imposti dalle condizioni non favorevoli del contesto.



Figura 14.1 Classe e Ravenna in età tardoantica.

I lavori condotti per la *Carta del Potenziale Archeologico di Classe*, attraverso un lungo processo critico di acquisizione e sistematizzazione del dato archeologico, hanno permesso di giungere a una definizione piuttosto precisa dell'antica città e del suo territorio ma, per diversi aspetti, ancora poco chiara.

Nonostante gli esemplari lavori di aerofotointerpretazione svolti su Classe negli anni Sessanta del secolo scorso da Giulio Schmiedt (Schmiedt 1962; 1968) e le successive considerazioni di carattere topografico di Nereo Alfieri,

Giuseppe Cortesi, Maria Grazia Maioli (Alfieri 1967; Cortesi 1967; Maioli 1990), poche certezze si hanno sia per quanto concerne la sua topografia antica, quindi il sistema idrografico e la viabilità, sia il suo assetto urbano, quindi le mura della città, l'articolazione interna e i principali edifici, nonché delle trasformazioni subite dal paesaggio nel corso della storia. Perseguendo la strada intrapresa dal progetto della carta del potenziale, dal 2005 si è deciso di ricorrere a una nuova strategia di ricerca condotta attraverso la raccolta e lo studio di fotografie aeree e l'impiego di tecniche di indagine con le quali entrare in rapporto diretto con le evidenze telerilevate, con l'obiettivo di approfondire la conoscenza del paesaggio urbano antico.²

Metodologia

La zona di Classe, all'estremità meridionale dell'antico delta del Po, è un territorio complesso che nel corso dei secoli ha subito profonde trasformazioni che ne hanno sempre reso difficile la ricostruzione. Proprio la complessità che contraddistingue il nostro contesto di indagine, ci ha portato a prediligere e a insistere su uno dei concetti chiave della moderna archeologia dei paesaggi, ovvero l'integrazione di diverse fonti, metodologie di indagine e tecnologie informatiche. Se le analisi storiche, geomorfologiche e topografiche non costituiscono di certo una novità negli studi dedicati a Ravenna e alla sua città satellite, la principale innovazione apportata dal presente progetto alla lunga tradizione di ricerche su Classe è relativa alla sperimentazione di tecniche di telerilevamento e, in particolare, al loro utilizzo sistematico e integrato. L'approccio al contesto è stato concepito come multiscalare, da macro territoriale fino a livelli puntuali rappresentati dai singoli siti. Si è partiti dalla raccolta di ortofoto da satellite e di fotografie aeree verticali a medio-piccola scala, in modo da favorire la comprensione della morfologia del territorio e della sua topografia secondo un'angolazione allargata, per poi passare a tecniche capaci di offrire un grado di dettaglio superiore, tentando anche di rispondere ad alcune domande relative a singoli siti o all'antico tessuto urbano, come le prospezioni aeree e geofisiche. L'integrazione di tutte le fonti utilizzate rappresenta la chiave di lettura dell'intero progetto ed è stata favorita dalla creazione di una piattaforma GIS, che ha permesso la raccolta e la gestione della mole dei dati in un unico archivio interrogabile e di affrontare i fenomeni studiati anche in termini statistici e di distribuzione spaziale. In una fase preliminare, si è dedicata una particolare attenzione al recupero di tutta la documentazione aerofotografica esistente relativa al contesto di studio, che è stata acquisita su supporto cartaceo e digitale, avviandone una catalogazione informatizzata.³ Sulla scorta poi delle prime esperienze di aerofotografia archeologica maturate a Classe negli anni Sessanta del secolo scorso (*Atti* 1962; 1968) e dei limiti emersi dallo studio vincolato alle sole fotografie aeree verticali disponibili, si è deciso di avviare un programma organizzato e sistematico di ricognizioni aeree a bassa quota,

con raccolta di una nuova documentazione costituita da fotografie aeree oblique. L'inizio delle attività di volo, nel 2007, è stato facilitato dalla proficua collaborazione instaurata con l'AeroClub di Ravenna, utilizzando un aeromobile Cessna 172, pilotato da un esperto aviatore che ha coadiuvato tutte le operazioni di ripresa.⁴ La strategia di lavoro ha previsto frequenti attraversamenti dell'area di studio, sorvolata sotto diverse angolazioni, con circoli ripetuti sopra gli obiettivi individuati. Il monitoraggio del territorio in differenti stagioni e condizioni meteorologiche, sta permettendo di determinare i momenti più propizi per la leggibilità del terreno nelle diverse zone, in parte legata alle variazioni stagionali e all'utilizzo dei suoli.



Figura 14.2 Fotografie aeree oblique realizzate nel territorio di Classe durante le ricognizioni aeree (estate 2008).

Grazie alle nuove attività di ricognizione aerea, oltre a incrementare la documentazione già esistente relativa ad alcuni siti del territorio di Classe, si è avviato il censimento di nuovi siti e di possibili emergenze archeologiche precedentemente sconosciute⁵ (Figura 14.2). L'individuazione delle tracce, tramite fotolettura del materiale esistente e i nuovi voli, è stata seguita da una registrazione standardizzata dei dati, da restituzione cartografica e da fotointerpretazione (Figura 14.3).

Per le aree più significative, è stata effettuata una verifica a terra delle anomalie individuate, mediante indagini geofisiche, ricognizioni di superficie e scavi archeologici mirati.⁶ In particolare, le aree campione finora sottoposte a prospezioni geofisiche sono state selezionate nel tentativo di rispondere ad alcuni quesiti derivati durante la redazione della *Carta del Potenziale Archeologico di Classe*.

Risultati

Da un punto di vista metodologico, la scelta di ricorrere alla fotografia aerea e a sistemi successivi di verifica delle tracce, quali indagini geofisiche, ricognizioni di superficie e scavi, si è rivelata certamente efficace, benché il contesto di studio sia molto particolare e non sempre adatto. Come ricordato più volte in precedenza, i *difficult soils* del territorio di Classe, dovuti soprattutto alla composizione argillosa di buona parte dei suoi terreni, hanno spesso costituito un inconveniente sia in fase di interpretazione delle tracce sulle immagini aeree per i ricorrenti fenomeni di inversione di tono, sia per le applicazioni geofisiche, in particolare per il metodo radar, contrastandone la capacità di penetrazione in profondità. D'altra parte però, soprattutto nelle zone caratterizzate da terreni più sottili e in corrispondenza dei suoli più sabbiosi degli antichi cordoni dunosi, è stato possibile acquisire dati importanti e altamente informativi da tutte le tecniche applicate.



Figura 14.3 Attività di ricognizione aerea, restituzione grafica e aerofotointerpretazione delle evidenze.

Senza dubbio le informazioni più numerose e attendibili si sono ottenute soprattutto dall'integrazione di tutte le fonti di dati utilizzate, e l'apporto dello spoglio della cartografia storica, delle fonti scritte e archeologiche, è stato fondamentale e in diversi casi risolutivo soprattutto in fase di interpretazione.

Le ricerche condotte in maniera intensiva nei tre siti di seguito descritti, stanno restituendo elementi importanti ai fini della ricostruzione del tessuto insediativo della topografia urbana di Classe, fornendo dati su alcuni complessi monumentali (basilica Petriana, basilica e monastero di San

Severo), sulle mura urbane e altre infrastrutture. I sondaggi stratigrafici di verifica realizzati in seguito hanno permesso di verificare i dati delle prospezioni e di appurare le interpretazioni formulate sulla base dei survey. Per i siti di podere Mazzotti (basilica Petriana) e di San Severo, è tuttora in corso un'attenta analisi incrociata dei dati di scavo e dei risultati delle prospezioni geofisiche, che sta anche consentendo di comprendere meglio le risposte strumentali ottenute in molte delle zone indagate.

Basilica Petriana

Le ricerche condotte presso il podere Mazzotti ne fanno il più completo caso di integrazione metodologica finora realizzato a Classe. Dal 2004 il sito è stato trasformato in un'autentica area test per diverse tecniche di diagnostica archeologica e l'approccio multistage al contesto ha portato a un continuo meccanismo di feedback tra i livelli di interpretazione, analisi e verifica dei dati, mediante controlli a terra e, in particolare, a partire dal 2008, con lo scavo archeologico di aree campione.

Se l'analisi delle fotografie aeree, storiche e moderne, e i preliminari rilievi georadar e geoelettrici hanno fornito dati utili per l'individuazione di strutture sepolte e sullo spessore del deposito archeologico, i survey geomagnetici (con gradiometro Overhauser e gradiometro al cesio) si distinguono per la rappresentatività delle restituzioni che permettono di apprezzare con un buon grado di dettaglio l'estensione e l'articolazione interna del record archeologico (Figura 14.4).⁷



Figura 14.4 Sito della basilica Petriana. Mappa del gradiente verticale ottenuta con magnetometro al cesio in configurazione gradiometrica (H. Becker e F. Boschi). Nei riquadri a destra, vari momenti delle attività svolte sul campo.

Sulle mappe magnetiche è ben leggibile un complesso di vaste

proporzioni, composto da una grande basilica a tre navate e abside centrale, un secondo edificio a pianta quadrangolare, posto più a nord, forse anch'esso tripartito e con navate laterali terminanti con due absidiole, e diverse altre costruzioni di più incerta interpretazione, riconoscibili a nord-ovest e a sud rispetto all'impianto basilicale. In particolare, verso sud, si segnalano un settore caratterizzato da una concentrazione di anomalie magnetiche positive probabilmente riferibili a corpi caratterizzati da un'elevata magnetizzazione termorimane che suggeriscono, anche per forma e dimensioni, la presenza di un quartiere artigianale con fornaci o calcare, e alcuni lineamenti fra loro ortogonali che sembrerebbero appartenere a un'ulteriore costruzione posta all'estremità meridionale del podere (Figura 14.6). Le tracce visibili sulle immagini aeree nel campo adiacente ne suggeriscono inoltre una prosecuzione verso sud.

Alcune riflessioni sono ricavabili anche dal confronto con i dati di scavo.

La mappe di gradiente ottenute con i sistemi geomagnetici, Overhauser e al cesio, rivelano che le anomalie lineari riferibili ai livelli di fondazione delle murature sono dovute a un'assenza di materiale magnetizzato, in contrasto con il terreno circostante o ai piani pavimentali all'interno degli ambienti da esse delimitati; in sostanza lo scavo delle fondazioni ha alterato il continuo del suolo normalmente caratterizzato da alti valori di magnetizzazione magnetica. Questo dato permette di ipotizzare una conservazione delle murature limitata soltanto ai livelli di fondazione, per lo più realizzati in pietra calcarea legata con poca malta, e dunque debolmente magnetiche, come emerso anche dai recenti saggi di scavo condotti proprio a verifica dei risultati delle prospezioni. Tale interpretazione è confermata anche dai risultati ottenuti con i sistemi radar ed elettrico, i quali delineano le strutture di fondazione come caratterizzate da una bassa conducibilità elettrica-alta resistività, come ci si deve aspettare per una struttura principalmente costituita da roccia carbonatica.

In corrispondenza dell'abside, invece, lo scavo ha documentato la presenza di una grande fossa di spoliatura. Benché lo scavo della fossa sia ancora in corso, è ipotizzabile che non si conservino persistenze strutturali dell'abside stessa, e che l'anomalia magnetica sia dovuta in questo caso proprio allo scavo della fossa di spoliatura e al suo riempimento. Ipotesi che sembrerebbe suffragata anche dai risultati dell'indagine georadar.

A ridosso della navata sud, in prossimità dell'attacco dell'abside, sulla mappa magnetica è osservabile una forma circolare caratterizzata da proprietà magnetiche positive che lo scavo ha rivelato essere una fornace circolare a tiraggio verticale realizzata in laterizi (che giustificano proprio l'elevata magnetizzazione della costruzione), impostata sopra i resti della basilica probabilmente in età bassomedievale.

Il *case history* della basilica Petriana dimostra ancora una volta come il rapporto tra archeologia e geofisica non sia affatto unidirezionale, ma che le discipline possano trarre simultaneamente vantaggi e informazioni l'una

dall'altra. Così, se nella definizione della strategia di scavo le indicazioni provenienti dalle prospezioni possono fornire un valido contributo, l'interpretazione dei dati geofisici trova un supporto importante nel riscontro dello scavo archeologico, permettendo magari di confermare le interpretazioni formulate o di estendere, sulla base delle restituzioni ottenute, il dato proveniente dal campione scavato.

Mura Urbane (podere Minguzzi)

Gli scavi condotti dal 2006 presso il podere Minguzzi in collaborazione tra il Dipartimento di Archeologia dell'Università di Bologna, il Dipartimento di Scienze Storiche dell'Università di Ferrara e la Soprintendenza Archeologica dell'Emilia Romagna, sono stati affiancati da una campagna di prospezioni geomagnetiche.⁸ In questo caso è stato sperimentato un gradiometro al potassio GEM System GSMP-35 di ultima generazione riadattato secondo una configurazione appositamente messa a punto per l'applicazione in campo archeologico (Boschi 2009: 412). Complessivamente è stata coperta una superficie di quasi due ettari e mezzo (Figura 14.5, a). Benché l'area sia stata già ampiamente rimaneggiata (dal 2006 è oggetto delle ricerche più recenti e sono stati aperti diversi saggi e trincee esplorative) (Augenti 2011; Lepore e Montevecchi 2009), le indagini hanno restituito esiti incoraggianti permettendo di individuare la probabile prosecuzione del tratto murario attribuito alle mura urbane di Classe intercettato dagli scavi 2006–2008 e molte altre evidenze di possibile rilevanza archeologica, delle quali si propone un'interpretazione ragionata anche in relazione all'integrazione con i dati di scavo (Figura 14.6).

Rispetto alle mappe di gradiente magnetico ottenute presso il sito della basilica Petriana, in questo caso le strutture appaiono meno leggibili, probabilmente a causa del minore contrasto di magnetizzazione fra i target sepolti e il terreno inglobante, dove abbondano livelli di macerie, e della maggiore profondità alla quale giacciono i resti archeologici (mediamente superiore a 2m), come dimostrato dagli scavi. Tuttavia, è ipotizzabile una prosecuzione delle mura urbane sia a sud sia a nord del torrione circolare scavato. Nella Figura 14.6, le anomalie riferibili con maggiore certezza allo sviluppo delle mura sono indicate con una linea bianca continua e misurano, a sud del torrione, c. 48m, e a nord c. 32m. Oltre questa distanza, il proseguimento verso nord non è più individuabile con precisione e può essere soltanto ipotizzato (per tanto si è scelto di restituirlo graficamente mediante una linea tratteggiata). La presenza di due anomalie magnetiche di forma circolare delle dimensioni simili a quelle del torrione rinvenuto con lo scavo (diametro di c. 10m) e fra loro distanti c. 32m, sembrerebbe suggerire uno sviluppo delle mura verso nord per altri c. 93m. Va precisato che in questa parte del campo la lettura dei dati magnetici risulta fortemente disturbata dall'abbondanza di strati di macerie e di numerose evidenze sovrapposte probabilmente riferibili sempre a resti archeologici sepolti.

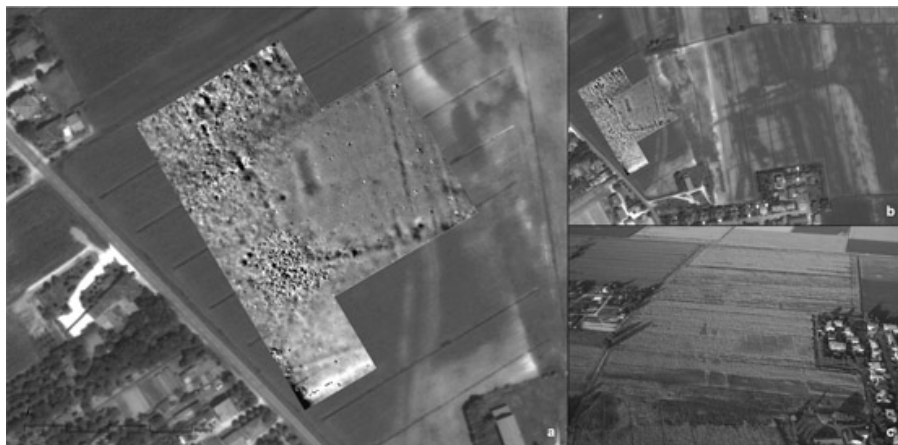


Figura 14.5 Sito di podere Minguzzi (mura urbane): a) mappa del gradiente verticale ottenuta con gradiometro al potassio (F. Boschi); b) sovrapposizione della mappa del gradiente verticale all'immagine Quickbird 2003; c) Foto aerea obliqua (estate 2008).



Figura 14.6 Indagini geomagnetiche presso i siti della basilica Petriana e di podere Minguzzi e interpretazione delle principali anomalie magnetiche.

Più facilmente leggibili sono altre anomalie magnetiche lineari, per lo più positive (indicate in nero) e, stando anche dai dati di scavo, forse riferibili a canalette in laterizio. La forma semicircolare, del diametro di c. 15m, individuabile invece a nord-ovest sulla mappa magnetica sembrerebbe ricordare, per forma, dimensioni e proprietà magnetiche, le evidenze registrate presso il podere Mazzotti e interpretate in riferimento a calcare o fornaci.

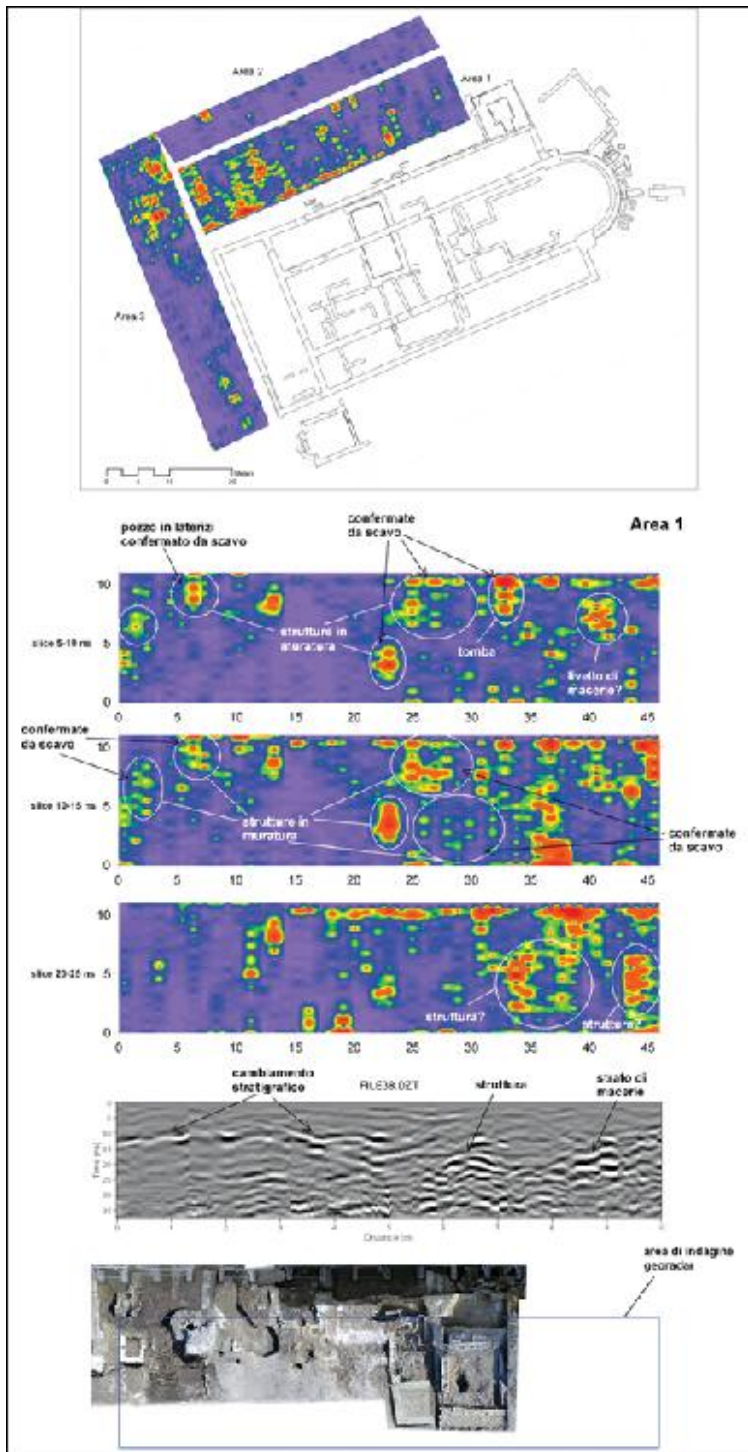


Figura 14.7 Indagini georadar presso la basilica di San Severo (estate 2006). In alto, mappa generale delle aree indagate. In basso, risultati nell'area 1 (sopra la navata laterale nord): slice-maps relative a varie profondità di indagine, interpretazione e confronto con i dati di

Altro elemento di particolare interesse è la presenza di un'anomalia lineare lunga c. 95m (e larga in media 3m), che dal torrione scavato si dirige verso est. Per caratteristiche magnetiche fa pensare a un'evidenza negativa (ad esempio un canale o un fossato). L'analisi delle fotografie aeree, in particolare un'immagine satellitare Quickbird del 2005 e alcune prese scattate durante le ricognizioni aeree del 2008 (Figura 14.5, b–c), permette di allargare lo sguardo sul territorio circostante e di dare sostegno all'interpretazione, rivelando l'esistenza di un grosso fossato che sembra dirigersi in linea retta a mare. L'integrazione con i dati di scavo aggiunge un elemento in più perché, esattamente in corrispondenza dell'anomalia magnetica, è stato individuato proprio un canale, largo c. 3m, in un punto di confluenza di due canalette e, forse, anche di una terza che attraversava il torrione. Tutti questi indizi portano a pensare a un largo condotto che garantiva una comunicazione a mare, forse un sistema artificiale di deflusso delle acque, che poteva sfruttare un taglio naturale nei cordoni dunosi.

Quello di podere Minguzzi è un caso di interpretazione dei dati magnetici non facile, dove l'integrazione con tutte le fonti di dati disponibili assume una rilevanza ancora maggiore e che, già in questa fase preliminare, sta restituendo informazioni importanti.

Basilica di San Severo

I nuovi scavi iniziati nel 2006 presso il sito di San Severo, sono stati preceduti da una campagna di indagini geofisiche che ha integrato georadar e magnetometria.⁹

La ricerca è stata effettuata principalmente in corrispondenza delle aree che sarebbero poi state interessate dai lavori di scavo, con lo scopo di verificare l'effettivo potere risolutivo, sia areale che in termini di profondità, delle tecniche adottate in vista di una loro eventuale utilizzazione nel resto del sito. Infatti, tra i motivi di interesse vi era la volontà di testare la possibilità di impiego dei sistemi radar e geomagnetico, in configurazione differenziale, in una situazione geoambientale piuttosto complicata, sia perché caratterizzata da strutture murarie sepolte costruite in materiale simile, o uguale, a quello presente nei livelli di crollo e di macerie soprastanti, sia per la natura argillosa e salina del terreno che le contiene.

Nonostante le difficoltà legate al contesto, alcuni risultati ottenuti con il GPR, in particolare a fianco della navata laterale nord, hanno rivelato la presenza di evidenze di forma regolare associabili a elementi di interesse archeologico, alcune delle quali sono state puntualmente confermate dagli scavi (Figura 14.7).

Conclusioni

Uno sguardo complessivo alle nuove esperienze di remote sensing condotte a Classe, unitamente ai risultati degli scavi condotti su più fronti a partire dal 2001, permette di apprezzarne il contributo alla ricostruzione della topografia urbana e di fissarne alcuni importanti capisaldi, fornendo anche una incoraggiante conferma della validità della nuova strategia di ricerca e dell'impostazione metodologica adottata (Figura 14.8).

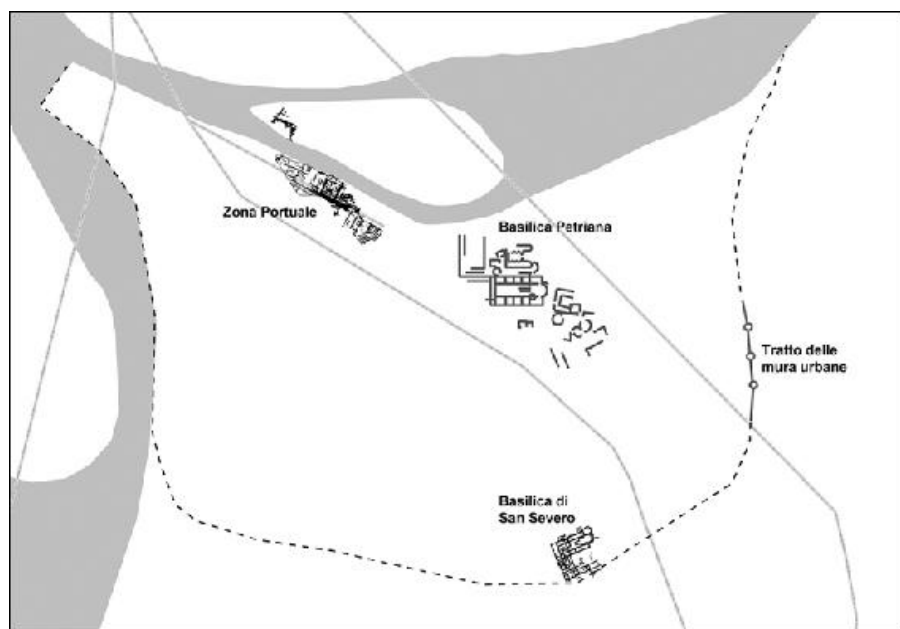


Figura 14.8 Rappresentazione schematica dell'area urbana di Classe in età tardoantica integrata con i dati derivati dalle nuove indagini geofisiche (in nero, le strutture archeologiche visibili).

Le ricerche fin qui condotte possono rappresentare un punto di partenza per la programmazione e la realizzazione dei futuri interventi sul campo, soprattutto in vista della realizzazione del Parco Archeologico di Classe.

Sarà certamente da perseguire con sistematicità e regolarità, anche per il buon rapporto tra costi e risultati ottenibili, il programma avviato di ricognizioni aree oblique affiancandogli una più intensa attività di controlli e di verifica a terra delle evidenze, magari con progetti organizzati di ricognizioni di superficie. Allo stesso modo andrebbero intensificate le indagini geofisiche nelle zone di importanza nevralgica per la comprensione di determinate problematiche, legate al tessuto urbano vero e proprio e al territorio circostante. Di particolare utilità potrebbero rivelarsi inoltre nuove campagne di carotaggi, da posizionare con criterio e in maniera ragionata sulla base dei risultati conseguiti e dei nuovi interrogativi a cui dare risposta.

Gli spunti per nuove attività sono numerosi e il lavoro da fare per attribuire un significato concreto alle tante identificazioni e interpretazioni formulate è ancora lungo, ma continuando a seguire questa direzione e questa

strategia di ricerca fondata sull'integrazione delle diverse fonti e metodologie, sarà più facile giungere a una conoscenza approfondita del territorio di Classe, della sua archeologia e della sua storia.

Notes

- 1 La nuova stagione di ricerche e scavi a Classe, inaugurata nel 2001, è frutto della stretta collaborazione tra il Dipartimento di Archeologia dell'Università di Bologna, la Soprintendenza Archeologica dell'Emilia Romagna (dal 2001) e la Fondazione RavennAntica Parco Archeologico di Classe (dal 2003), che ha dato una forte spinta all'archeologia locale. Sulle nuove ricerche a Classe si rimanda a Augenti 2010.
- 2 Le nuove ricerche qui esposte sono state oggetto della tesi di dottorato di chi scrive, dal titolo *Tecniche di telerilevamento per l'archeologia dei paesaggi: il caso di Classe (RA)*, discussa presso l'Università di Siena nell'a.a. 2008/2009 (tutor. A. Augenti, S. Campana).
- 3 La ricerca ha previsto lo spoglio degli archivi fotografici dell'Aerofototeca Nazionale di Roma, dell'Istituto Geografico Militare di Firenze, dell'Ufficio Cartografico dell'Emilia Romagna, del Comune di Ravenna, del Dipartimento di Archeologia dell'Università di Bologna e ha portato anche all'individuazione di alcune piccole collezioni private, presso studi di fotografiprofessionisti.
- 4 Il velivolo utilizzato per le ricognizioni è un aeroplano leggero a quattro posti, ad ala alta e con finestrino apribile.
- 5 Tutte le fotografie sono state inserite nella piattaforma GIS e georeferenziate sulla base cartografica vettoriale di riferimento fornita dall'Ufficio Sistemi Informativi Territoriali del Comune di Ravenna. La georeferenziazione delle immagini aeree verticali è avvenuta in ambiente GIS, mentre per le prese oblique il processo di georeferenziazione è stato preceduto dalla rettifica delle fotografie mediante il software Airphoto 3.25. Per la restituzione grafica delle evidenze ci si è serviti di software di grafica del pacchetto Adobe o *open source* (Inkscape), mentre fase della fotointerpretazione vera e propria è avvenuta sempre in ambiente GIS, mediante la creazione di diversi livelli informativi per la restituzione dei vari tipi di tracce. Questo ha portato alla formulazione di un catalogo tipologico delle evidenze dell'area oggetto di studio. Per ognuna delle 224 evidenze finora cartografate è stata compilata una scheda del geodatabase appositamente ideato e interrogabile da GIS.
- 6 Anche per i risultati delle indagini geofisiche è stato concepito un geodatabase collegato alla piattaforma GIS, in modo che siano consultabili tutte le informazioni tecniche relative alle prospezioni, fornendo uno strumento capace di indirizzare le future acquisizioni a Classe con parametri mirati.
- 7 Le indagini geomagnetiche sono state condotte da Helmut Becker (Becker Archaeological Prospection, Beueberg, Germany) e da chi scrive, utilizzando un gradiometro al cesio e un gradiometro Overhauser (in collaborazione con il LAPeTLAB, Università di Siena). Si rimanda a Boschi 2010; Becker, Boschi e Campana 2009; Boschi e Becker 2010.
- 8 La direzione degli scavi è di S. De Maria (Dipartimento di Archeologia, Università di Bologna), J. Ortalli (Dipartimento di Scienze Storiche dell'Università di Ferrara), M.G. Maioli (Soprintendenza Archeologica dell'Emilia Romagna).
- 9 Sulle nuove indagini nel sito di San Severo si rimanda a Augenti 2006.

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Ground Penetrating Radar Survey of Urban Sites in North Coastal Etruria: *Pisae*, *Portus Pisanus*, *Vada Volaterrana*

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Introduction

The North Western Etruria Project is run by the University of Pisa, Dpt. Scienze Storiche del Mondo Antico, since 1982. It is an intensive ‘total archaeology’ research project (Darvill 2001; 36) with strong attention to ‘climatic changes and impacts’.

All available sources and data provided by diagnostic techniques are critically examined, including geomorphology; palaeogeography; non-destructive techniques applied to landscape and settlement archaeology (remote sensing, geophysical surveys); archaeological researches (intensive surveys and monitoring of surveyed areas, stratigraphic excavations, underwater archaeology); archaeometric and archaeological studies of finds (metals and pottery wares); bioarchaeology; the study of ancient and medieval epigraphic, literary sources and toponyms, historical cartography.

The data are processed in a diachronic perspective from the late Bronze Age up to the early Medieval period, with main focus on the late Etruscan, Roman and Late Roman period. Participant institutions are the University of Pisa and the Soprintendenza per i Beni Archeologici della Toscana (Florence); scientific collaboration is provided by DipTeRis (Genoa), CNR-ISTI (Pisa) and CEREGE (Aix-en-Provence). The Project has been supported by European Programmes (HCM, INTERREG, MEDOCC), by the Ministero dell’ Istruzione Università e Ricerca Scientifica, local and regional authorities, banks (in particular Fondazione Cassa di Risparmi di Livorno) and local firms. The palaeogeographic, archaeological and geophysical researches are overseen by several senior academic staff, plus many younger students.

In this paper we present the multidisciplinary results of three GPR surveys, respectively in the northern suburb of ancient Pisa (*Pisae*) and in two coastal settlements: *Portus Pisanus* (Livorno), the main Pisa ancient port, and *Vada Volaterrana* (Vada, Livorno), the main Volterra harbour in Etruscan and Roman times.

State of the art

In the Etruscan period Pisa (*Pisae*) and Volterra (*Velathri*, *Volaterrae*) were the main cities in north-western Etruria. Their territories included a coastal strip (respectively from the Magra to the Fine and from the Fine to the Bolgheri rivers mouths) and large hinterlands (Figure 15.1). Along the coast were ports and landing places, in the hinterland minor settlements, workshop centres, and *villae*.

Volterra was conquered by the Romans in the first half of the third century BC and Pisa became *civitas foederata* in the mid-third century BC; in the second century BC it was a Roman military base during the wars against the *Ligures* and in 180 BC it granted part of its northern territory for the creation of the Latin colony *Luca* (Lucca). In 177 BC, when the *Ligures* were defeated in northwest Tuscany, the Roman colony *Luna* (Luni) was founded (Ciampoltrini 2004). Between 42 (*Philippi* battle) and 31 BC (*Actium* battle) or after *Actium* the cities and most plains in North Etruria were remodelled by veteran colonization (Ciampoltrini 1981).

In northwestern Etruria the Triumviral-Augustan colonization marked a notable economic growth both in farming, manufacturing and trade (Pasquinucci and Menchelli 2010) and had a strong impact on the cities and their territories. The landscape kept substantially steady in most areas till the mid sixth century (Cherubini *et al.* 2006).

Pisae

Recently the toponym (Greek: *Pisa/Pisai/Peisa/Peisai*; Latin: *Pisae*) has been interpreted as Indoeuropean, meaning a site rich in water, both stagnant and fluent (Dini 1994). In the late seventh–early sixth century BC the Etruscan town emerged based on a few settlements on low mounds separated by major and minor streams, in the area where the river *Auser* (an ancient branch of the Serchio) flowed into the Arno (Strab. 5.2.5; Plin. *N.H.*, 3.50; Rut. Nam. 1.566; Schol. Ptol. 3.1.4.), on the right bank of the latter (Pasquinucci 2003). The site was an important crossroad, where the North Tyrrhenian coastal itineraries intersected the road system following the Arno and Serchio valleys. The rivers were a natural defence, a resource and a risk: recurrent floods are archaeologically documented both in the ancient town area and in the territory.

The layout of the archaeological finds and the identification of necropoleis prove that the Etruscan settlement was scattered on several low mounds formed by previously deposited fluvial sediments and separated by river branches and streams. Most streams progressively silted up after the fourth–third century BC. Relevant evidence of the Etruscan and Roman town is provided by archaeological excavations in the city centre (via S. Apollonia; piazza Duomo; piazza Dante: Pasquinucci 2003). Around 480 BC a flood damaged large part of the town area (Bruni 1998: 137, 198: evidence in piazza

Duomo, piazza Dante).

In the last decades of the first century BC the colonia *Opsequens Iulia Pisana* was founded. Intense town planning and building activities affected the town area; a vast *centuriatio* was constructed in the plain. The colony's imposition had a dramatic impact on the social and the economic structures.

Evidence of the late-Republican to late antique suburban landscape is provided by a few shipwrecks sunk in the *Auser* by floods, one of which is dated around AD 10 (Camilli 2005). The wrecks are dated from the second half of the second century BC to the late sixth–early seventh AD. In Roman times the North suburb was dotted with *villae*, pottery workshops and necropoleis (Pasquinucci, Menchelli 2008).

Portus Pisanus

Pisa lay 20 *stadia* from the coast according to Strabo (5.2.5) and his sources (therefore in the late republican–early imperial period). The distance increased progressively because of the North Etruscan coast progradation, interpreted as a consequence of the colonization impact on the hinterland and possibly of a phase characterized by intense rainfall (Pasquinucci 2007; Pasquinucci and Menchelli 2009).

The town and its territory had a well integrated system of sea and river ports and landing places. The main port was situated north-northeast of present Livorno, as documented by literary and archaeological sources. It was protected by offshore shoals in the offing and by the Livorno shallow rocky promontory. The harbour was active since the archaic period; after the second–first century BC its location shifted progressively westwards due to coastline shift. In the early fifth century AD it was described as rich and safe by the poet Rutilius Namatianus (*de reditu*, 530 ff.). It was named *Portus Pisanus* at least since Late Antiquity (*Itinerarium Maritimum*: 501) and in the Middle Ages.

In the area notable Roman buildings were described by Targioni Tozzetti in the mid-eighteenth century; a large late Roman necropolis was excavated in the late nineteenth century (Targioni Tozzetti 1768; Pasquinucci and Menchelli 2010). Recent excavations have brought to light evidence of the port settlement and stretches of the adjacent seabed (Ducci, Pasquinucci and Genovesi 2007). Palaeogeographic and archaeological research proves that this stretch of shallow water could be navigated by appropriate crafts in order to load and unload cargoes at least since the late seventh–early sixth century BC (Stefaniuk *et al.* 2007). In the fourth–third century BC stone blocks and posts were set up either to reinforce the shoreline or to provide a dock (Pasquinucci and Menchelli 2010).

The area was progressively and rapidly silted up by alternate sand and *posidonia* layers from the mid-second century BC; in the late first century BC the port activities were therefore shifted westwards. *Portus Pisanus*, together with *Luna* and *Vada Volaterrana*, the main North Etrurian harbours, appears

to have been strictly linked to the Mediterranean trading routes up to Late Antiquity.

Vada Volaterrana

Vada Volaterrana, main harbour of *Volaterrae* in Etruscan and Roman times, was located north of the ancient Cecina river mouth, along the coastal road (via Aurelia since the third century BC), 25 *milia* from Populonia and 18 from *Portus Pisanus* (*Itinerarium Maritimum* 1,501) (Menchelli and Pasquinucci 2006). Part of the ancient town lies under present Vada, which keeps the ancient toponym. On the grounds of geomorphologic and archaeological data, the harbour was located in the sheet of water in front of the town. It was protected by a large shoal system; its access was described by the poet *Rutilius Namatianus* (1, 453 ff.) in the early fifth century AD. Immediately north east of this area, in the San Gaetano di Vada site, since 1982 we have been carrying out stratigraphic excavations which brought to light a Roman quarter evidently related to the harbour.

Huts dated to the ninth century BC were identified under the Roman settlement, on the coastal dunes; they were abandoned because of a brackish water flooding documented by malacofauna. Two *thermae* (Figure 15.2, A and D), an *horreum* (B), an *aula* (C), a fountain (E), a *schola* (F), a triconch building (G) and a large complex (H) with tanks and a drying-kiln have been excavated so far.

This Roman quarter was built in a unitary project starting from the early decades of the first century AD; its activities continued up to Late Antiquity. The buildings underwent systematic renovations and functional changes in the middle Imperial Age. A crisis is documented by a necropolis partly covering the *horreum* (B) and the bath (D) in the late third–fourth century AD, as confirmed by the calibrated C14 dating of one of the skeletons (AD 267–377: analysis by ANSTO, Physics Division, Menai, Australia). Afterwards, the buildings were restored and intense import-export activities are documented up to the early seventh century AD.

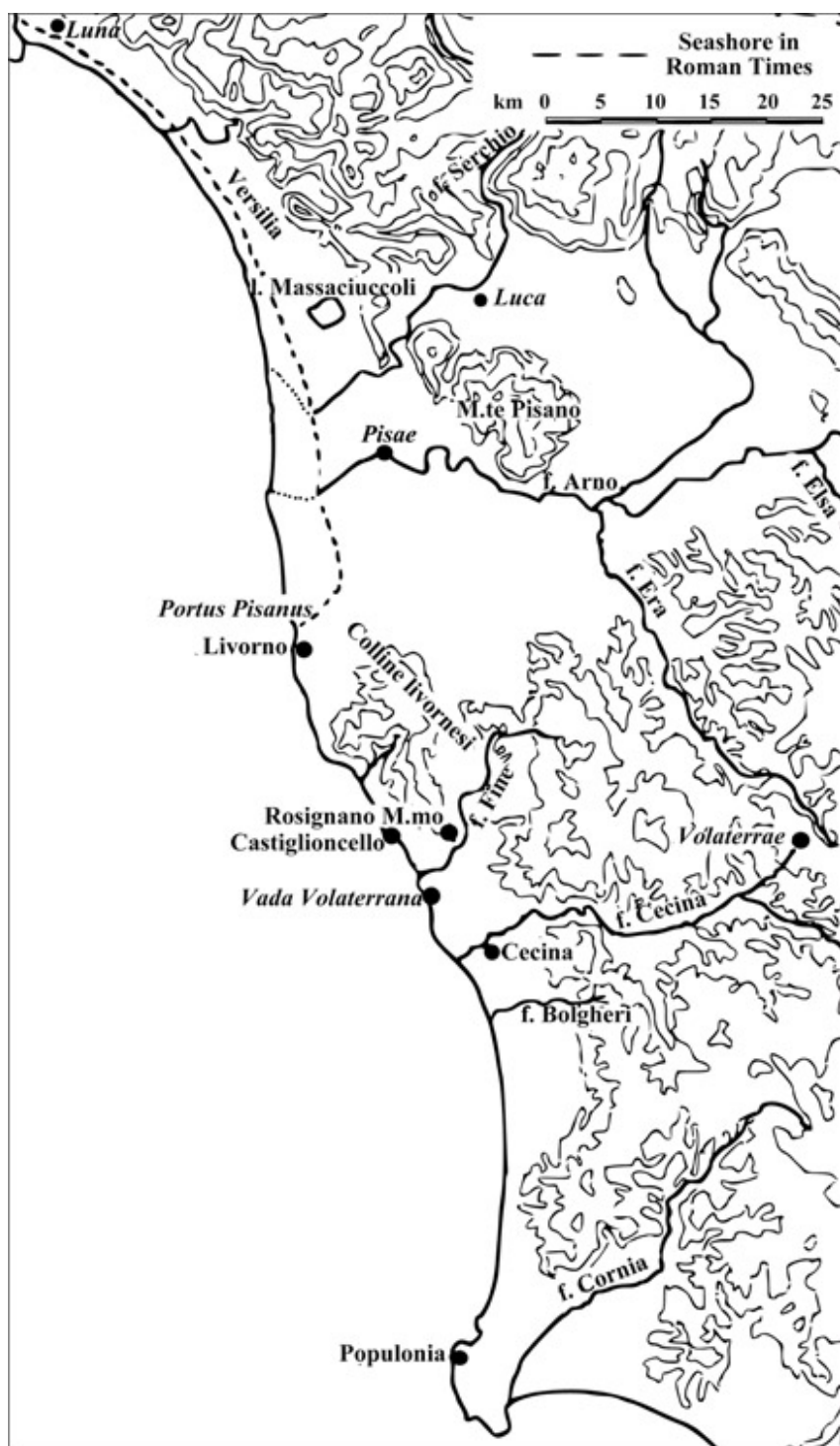


Figure 15.1 North coastal Etruria.

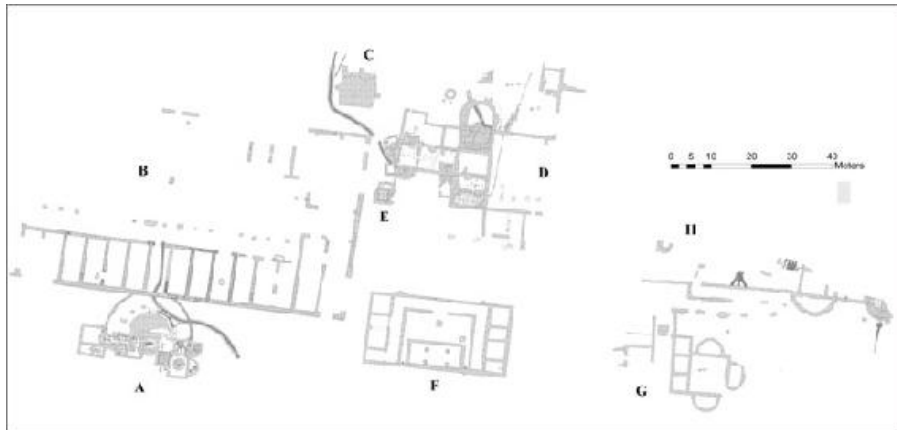


Figure 15.2 Vada Volaterrana. Archaeological area in S. Gaetano di Vada (Rosignano M.mo, Livorno).

From the archaeological data we can identify a close economic relationships among *Vada Volaterrana*, *Volaterrae* and their hinterland, which was rich thanks to agricultural, breeding, manufacturing and commercial activities and to many natural resources (copper; alabaster; sea- and rock-salt; timber) (Menchelli and Pasquinucci 2006).

Methodology

Ground Penetrating Radar (GPR) is a fast and cost-effective electromagnetic (EM) method providing relevant information on the shallow subsurface. Since it is based on the emission and reflection of EM waves, it is sensitive to variations of the EM parameters in the subsoil, especially the dielectric constant and the electric conductivity (Davis and Annan 1989; Smith and Jol 1995; Annan 2009). The lower the frequency of EM waves propagating into the subsurface, the greater their penetration depth. The capability to resolve targets vertically (vertical resolution) increases with the antenna frequency up to centimetre values, while lateral resolution depends on the geometry of acquisition (step size, i.e. the distance between each point where a measurement is made along a GPR profile) and can reach sub-centimetric resolution.

Moreover, further significant advantages are reached adopting a grid of radar profiles, allowing a 3D visualization of the subsurface, and facilitating the interpretation of geometric structures such as archaeological remains (Malagodi *et al.* 1996; Nuzzo *et al.* 2002). The area of grid cell must be dimensioned to properly resolve the dimensions of the targets in the subsurface. Eventually, ‘time-slice’ (or depth-slice) maps can be used to display the plan pattern of radar data at variable depths (Goodman *et al.* 1995).

Hence, the expected results generally drive the compromise between

investigation depth and antenna frequency, as well as the acquisition geometry, i.e. step size and grid dimension.

Finally, GPR high resolution (lateral and vertical) and the modern techniques of data visualization (2D and 3D) make this method widely employed in archaeological investigations (Basile *et al.* 2000; Leckebush 2003; Grasmueck *et al.* 2004; Leucci 2006; Orlando 2007; Soldovieri and Orlando 2009).

In this study, the GPR survey has been performed using the Radar System device of IDS Company © (www.ids-spa.it), equipped with antennas of 200 MHz and 400 MHz of nominal peak frequency and HH polarized. The data were acquired in continuous mode, controlling the step size by means of an odometer wheel. In vertical direction, the subsurface was explored for 128 ns (range) adopting 512 samples per scan, while horizontally the radar source was triggered every 2.4cm.

A 0.5m grid cell was used to cover each of the surveyed areas. In some cases, the presence of obstacles on the surface limited the acquisition.

The raw data were processed adopting a standard sequence as follows:

- time-zero correction shifting the first arrivals by a constant;
- running average filter in order to filter the DC component (Dewow filter);
- linear and smoothed gain with window-length of 71 ns (5m depth);
- subtracting the mean trace in order to filter out the continuous fl at reflections caused by the breakthrough between the shielded antennas and by multiple reflections between the antenna and the ground surface (Daniels 2004);
- vertical band-pass filter;
- determination of EM wave velocity for depth conversion using the method of hyperbolic shape of a reflection from a point source (diffraction hyperbola).

After the above sequence of processing and analysing ‘time slices’ at various depths, the areas of high back-scattered energy corresponding to reflections of EM waves (anomalies in the following) were archaeologically interpreted.

Results

Pisa, area Via Galluppi

The studied site is located a few hundred metres north of the medieval city walls (Figure 15.3); this segment of fortifications most probably coincided with the Roman ones.

The area belonged to the northern *Suburbium* of *Pisae*, at present almost completely urbanized. In recent years a series of random finds have been made there, and rescue and preventive excavations were carried out

(Pasquinucci and Menchelli 2008).

In the Augustan period this district specialized in the production of *terra sigillata*: kiln wastes were found in via Santo Stefano, near via Galluppi. From here late Italian *terra sigillata* workshops were spread over a large part of the northern *ager Pisanus*. The medieval sources provide useful data to locate in this area both the course of the river *Auser/Oseris* and the bridge built across it near via S. Stefano (Garzella 1990: 57). Most probably in Roman times the topographic layout was very similar to the Medieval one, since the *sigillata* workshops identified in via S. Stefano used *Auser* clays, as shown by chemical and mineropetrographic analyses (Menchelli *et al.* 2001).

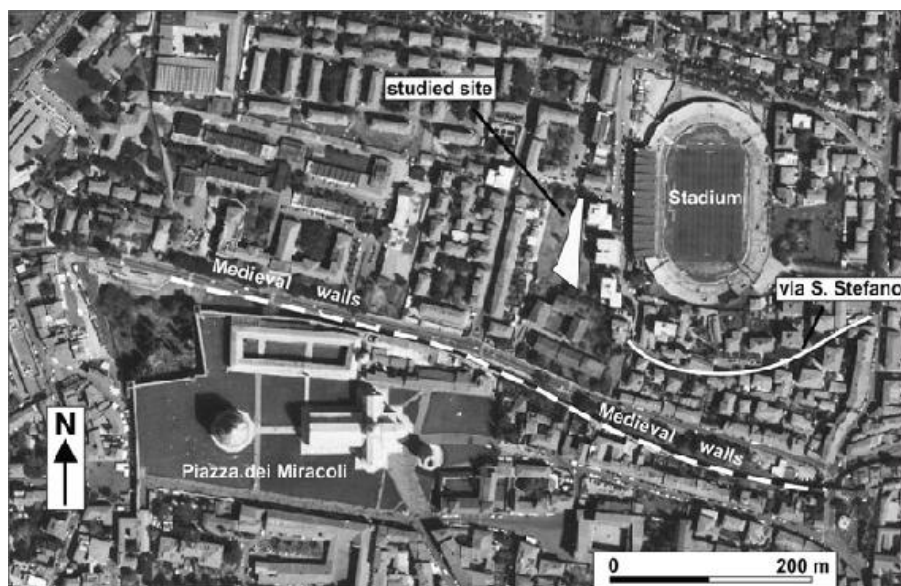


Figure 15.3 Pisa. An aerial view of the Pisae North suburbium.

The GPR survey was undertaken subdividing the area in three irregularly shaped adjacent sectors (Figure 15.4). An acquisition network of 0.5m grid cell was adopted in each sector. The central sector (sector 1, Figure 15.4, A and B) shows areas of high backscattered electromagnetic energy, drawing slightly continuous geometrical elements locally consistent with the existence of subsurface structures at various depths. In detail, from the perimeter of the archaeological excavation an evident anomaly extends perpendicularly to the centre of the sector. Other reflections evident up to 100cm depth are visible in the southern part of the sector.

In the centre of sector 3, reflective areas were detected from 40–110cm depth drawing a north–south orientated plurimetric element, up to 30–40cm wide (Figure 15.4, C and D). Other minor reflective areas are visible at various depths, oriented both perpendicularly and in parallel to the geometrical element previously mentioned. In the northwestern corner of sector 3 the pattern of radar anomalies at 110cm depth seems to enclose

spaces without reflections.

In sector 2 (Figure 15.4, E and F) a highly reflective area was detected at 30cm depth; in spite of the irregular limits, it assumes a sub-rectangular shape. Increasing the depth (70–80cm), it is evident that this area is bordered by a wide northwest–southeast anomaly, crossing the whole sector. The width of this continuous and high back-scattered energy area is about 200cm up to 110cm depth.

The excavations in progress in the site identified part of a Roman building (most probably a suburban *villa*) and a necropolis located southeast of it. The GPR results are consistent with this interpretation, showing elements interpretable as huge walls (at least 50–60cm wide) shaping regular rooms. In sector 2, the linear evidence can be interpreted as a street, continuing beyond the excavation area toward north east. Moreover, the round shaped reflective area in sector 3 can be referred to a kiln waste dump, in agreement with the acquired knowledge of the area (Pasquinucci and Menchelli 2008) and with the results of the excavations. Actually, during the excavations some mis-fired vessels were found, stamped by the Late-Italian potter L.S.M, who is well documented in the Santo Stefano kiln waste. Excavations have been scheduled for the future when we hope this interpretation will be verified.

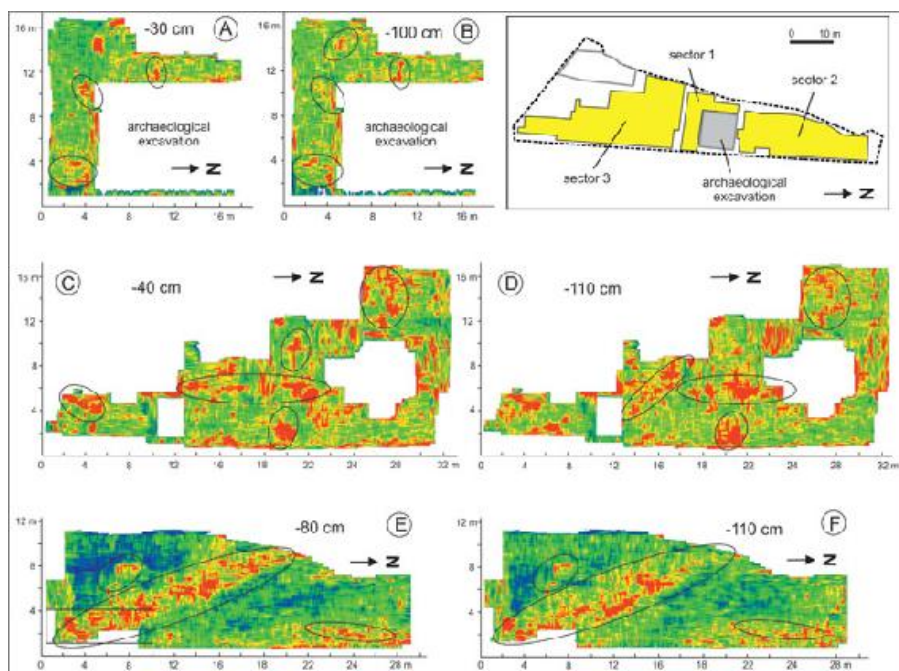


Figure 15.4 Pisa. Galluppi street. Time slices at various depths of the studied site.

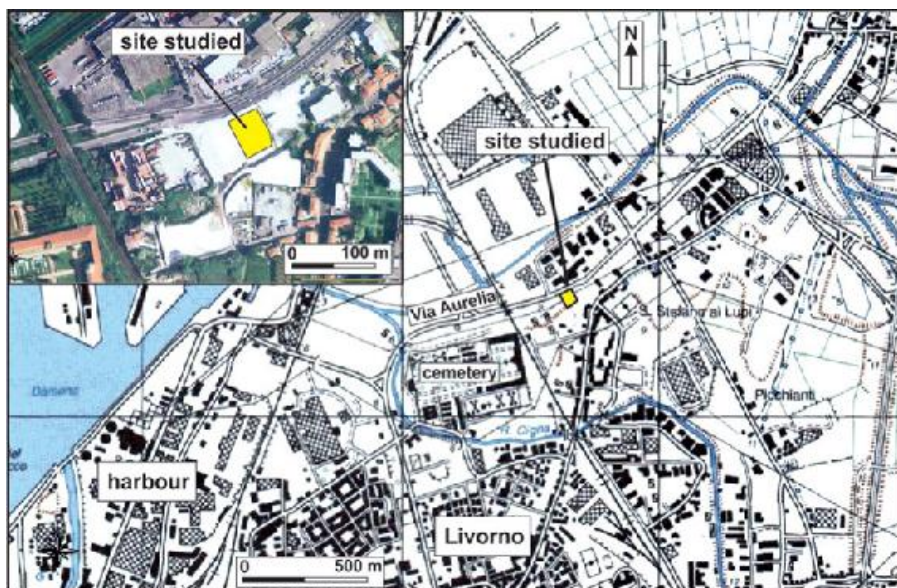


Figure 15.5 Portus Pisanus. (Livorno). Map and aerial view (in the inset) localizing the studied site.

Portus Pisanus

The survey was undertaken in the north-eastern periphery of Livorno, in the area of *Portus Pisanus* (Figure 15.5).

A sector of about 2000m² was prospected adopting a regular 0.5m grid cell network of acquisition. Differently from the previous cases, the radar system was acquired using contemporaneously a 200 MHz and 400 MHz antenna. The data elaboration corresponds to the processing of the two acquisitions.

Starting from 90–100cm depth in the eastern part of the surveyed area, several reflections are consistent with geometrical elements of variable shape and dimensions (Figure 15.6A). The reflections pattern is coherent with the regular shape of close polygons developing with a northeast–southwest trend (Figure 15.6B). The dimensions of the most evident polygons vary from about 15 to about 30m². The reflections preserve the characteristics of spatial continuity and coherency up to 130 cm depth (maximum depth of investigation).

GPR data show several linear elements variously oriented that can be interpreted as wide walls shaping a sequence of rooms. Other minor evidences seem not to be connected with the main building. According to the excavations carried out in the surveyed area, it was a commercial building (most probably a *horreum*) articulated in a central courtyard lined by a portico faced by quadrangular rooms. It is dated to the first century BC–sixth century AD and was constructed on a previous building (third–second century BC) (Pasquinucci and Menchelli 2010).

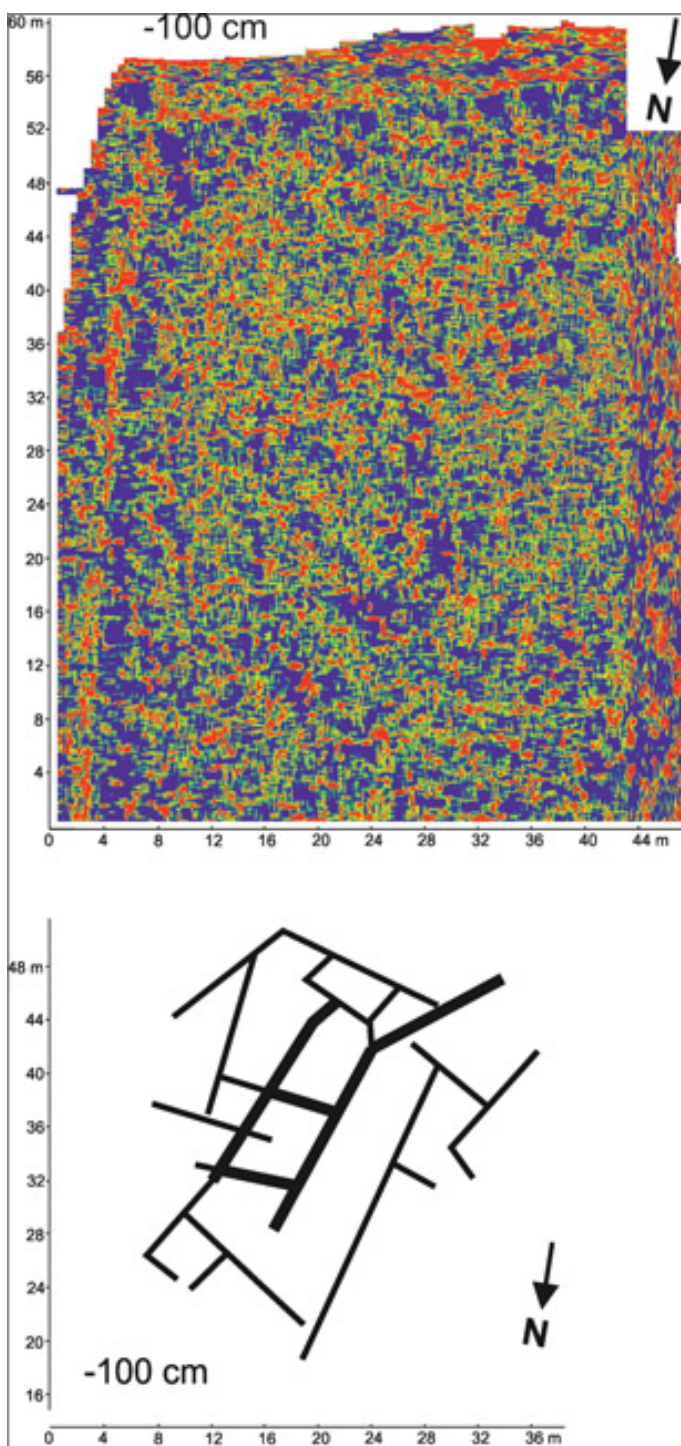


Figure 15.6 Portus Pisanus. (Livorno). Time slice at 100 cm depth in the site. A) drawing of the main reflective areas discussed in the text; B) black geometrical elements are interpreted as walls.

Vada Volaterrana (Vada)

The survey was undertaken immediately SE of the San Gaetano excavated area to test the potential prosecution of the archaeological finds toward the city of Vada (Figure 15.7A and B).

The time-slice at 110cm depth (Figure 15.8A) clearly shows the existence of geometrical elements whose general pattern is consistent with regular structure's of pseudo-rectangular shape, enclosing areas with no EM reflections. The structures dimensions are remarkable, with continuous and coherent EM reflections up to 100–130cm depth (Figure 15.8B). Near the eastern border of the rectangular structures, a wide and highly reflective area showing a curved limit toward north was detected.



Figure 15.7 A) Vada (Rosignano M.mo Livorno) and the remains of Vada Volaterrana. 1:

S. Gaetano di Vada commercial quarter; 2: unspecified Roman findings; 3: harbour area; 4–5: dwelling quarter; 6–7: necropolis. B) Vada Volaterrana. An aerial view including S. Gaetano di Vada and the studied site.

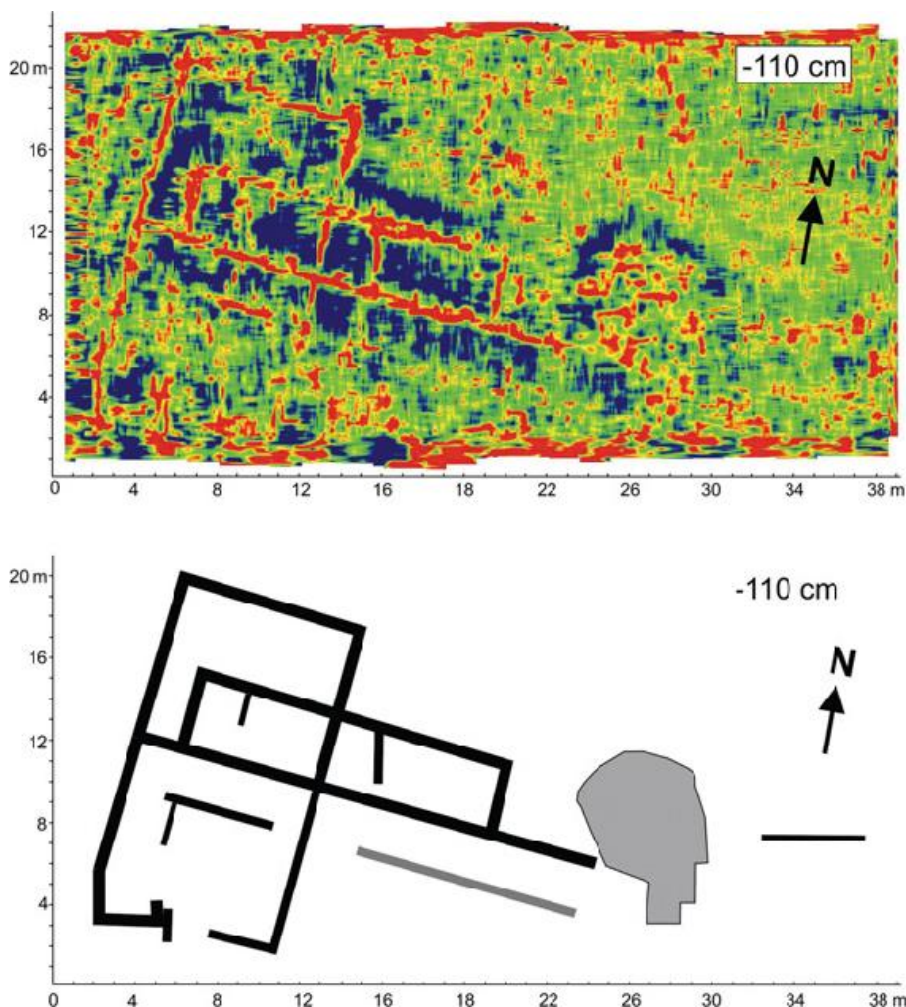


Figure 15.8 Vada Volaterrana. Time slice at 110cm depth in the site.

The GPR data show regular evidence of a building formed by several rooms. The walls appear to be at least 60cm wide, accordingly with the evidence of the excavated complex in the area. The round reflective area can be interpreted as the pavement of a cistern, supplying water to the complex through a drainage system identified by the minor linear anomalies located south of the rooms. Excavations in the area are planned for September 2011.

Conclusions

The results confirmed the GPR efficiency in the archaeological research. In *Portus Pisanus* the excavations results matched the GPR data and their

interpretation. In Pisa (Via Galluppi) and *Vada Volaterrana* the data agree with the archaeological knowledge of the area. Moreover, locally the reflective sectors are self-evident, showing clear geometrical shapes, certainly due to human activities.

The results confirm the capability of the GPR method to explore ancient areas being a non-invasive, rapid and relatively cheap prospection.

The planned extensive use of GPR could provide further data to reconstruct the suburban landscape of *Pisae* and to better define the topographical features of *Portus Pisanus* site. Moreover, systematic GPR prospection in the area between San Gaetano site and the modern Vada could provide evidence to identify the actual extension of the *Vada Volaterrana* town. Most probably in this area public and private buildings should be expected, on the basis of previous excavations and other findings.

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The *Ammaia* Project: Integrated Approaches for Studying Roman Towns in *Lusitania*

C. Corsi

Introduction

Ammaia is a mid-size Roman town located in the centre of ancient *Lusitania*, strategically positioned along the road connecting the Lusitanian capital *Augusta Emerita* (Merida) with the main western Lusitanian towns of *Scallabis* (Santarem) and *Olisipo* (Lisbon) (Figure 16.1). Nowadays, the area in which the town once stood lies in the municipal territory of Marvão, in the district of Portalegre. In modern geo-political terms, *Ammaia* is part of the Portuguese region of Alto Alentejo, which lies very close to the border with the Spanish Extremadura.

The intra-mural space of *Ammaia* is considered to be a trapezoid-shaped sloping area, which possibly included the hilltop of Malhadaís, on the western bank of the river Sever. The site is almost completely free of modern buildings, with the exception of a seventeenth century farm (*quinta*, in the Portuguese language) that now hosts an on-site museum, and the intrusive as well as unfortunate presence of the road connecting Portalegre with Marvão (Figure 16.2). The area of the urban site is almost fully owned by the Fundação Cidade de *Ammaia*¹. The Fundação is the ‘management entity’ of the archaeological park, the museum, the laboratory which deals with restoration and analysis, and the depot for archaeological finds.

In 2008, the University of Évora took over the full scientific responsibility of archaeological research in *Ammaia*. Several projects have been launched since this point:

- 1) ‘Geo-archaeological research of Roman landscapes in Alentejo’ [http://www.cidehus.uevora.pt/index_investiga.ht]. In this project, the research centre at UEvora, called CIDEHUS (Centro Interdisciplinar de Historia, Culturas e Sociedades), is collaborating with the Belgian University of Ghent and the Italian University of Cassino in developing a geo-archaeological approach to the region;
- 2) ‘Radio-Past’, a European FP7 Marie Curie/People Action IAPP project, entitled ‘Radiography of the past. Integrated non-destructive approaches to

understand and valorise complex archaeological sites'. In this project, four academic partners (Universities of Évora, Ghent and Ljubljana and the British School at Rome) and three SMEs (7Reasons – Austria, Past2Present – the Netherlands and Eastern Atlas – Germany) have pooled their resources in order to develop integrated approaches to studying different urban sites (mostly Roman) and searching for effective ways in which to present their results to a wider public (see the project website: www.radiopast.eu). *Ammaia* has been chosen in the framework of this project as the main 'open-lab' of the consortium (Corsi *et al.* forthcoming). The project Radio-Past was launched in April 2009 and will last for 48 months;

- 3) 'The *Ammaia* project. A concerted action of archaeology, natural sciences and applied technologies to place a Roman town in context' is financed by the Portuguese National Fund for Research (FCT). In this project, UEvora's (here represented by the research centres CIDEHUS and HERCULES) main partners are the Department of Electrical Engineering and the Institute for Systems and Robotics (ISR) of the Instituto Superior Técnico (IST) in Lisbon. The foremost objective of this project is the creation of opportunities to transfer knowledge and to validate developments and innovation in the methodology of archaeological surveys. One of the priorities of this project is the development of a new 'low budget' system for high-resolution low altitude LiDAR scanning. Another priority is to investigate further possibilities in the automation of certain types of field survey (such as geophysics). This project, which will last for three years, was launched in 2010.

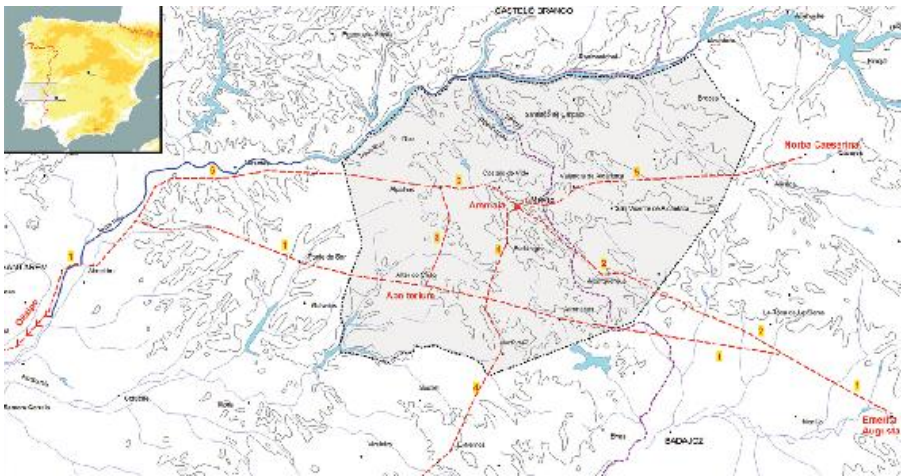


Figure 16.1 Map of the territory of Ammaia, with indication of the main road network (after Corsi and Vermeulen 2008).

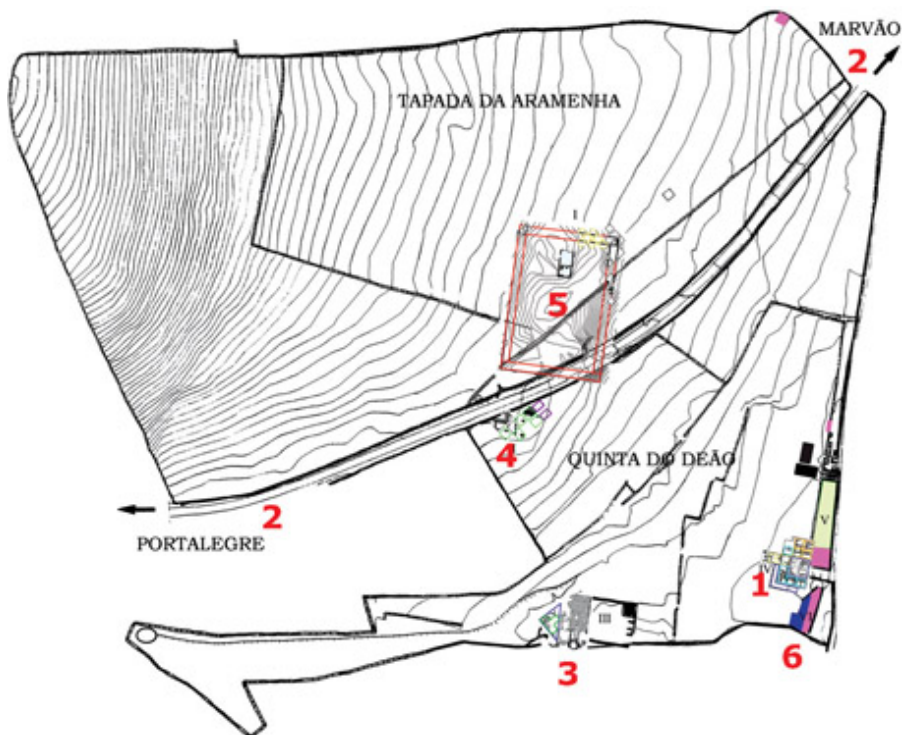


Figure 16.2 São Salvador de Aramenha (Marvão). Delimitation of the area owned by the Fundação Cidade de Ammaia, including most of the intramural surface of the Roman town of Ammaia. Numbers indicate the location of: 1) the on-site museum hosted into the building Quinta do Deão; 2) the modern road connecting Marvão to Portalegre; 3) the excavated area of Porta Sul; 4) the excavated area of the thermal baths; 5) the partially excavated area of the forum, 6) the excavated part of the town wall.

Field work in *Ammaia* is concentrated between May and October, but most of the researchers who are involved work full time all year round at different partner institutions, making good use of the opportunities of staff exchange foreseen in some of these actions.² Each summer an excavation campaign lasting for at least three weeks is also conducted on the site, which is intended to act as ‘ground-truthing’ for anything that has been detected using non-destructive surveys. On these occasions, approximately 25 students from different European countries are present on the site in addition to the six laboratory technicians who are permanent members of staff, between six and eight collaborators on different projects (doctoral students and post-doc), the scientists in charge and several researchers from partner institutions.

State of the art

The archaeological and historical identification of the site as the location of the Roman town of *Ammaia* dates from the mid-1930s (Vasconcelos 1935; Le Roux 1990; Mantas 2000). However, notwithstanding the fact that the area

was declared *Monumento Nacional* in 1949, fieldwork activities and historical research only began at the end of the twentieth century. Vasco Gil Mantas is responsible for most of the historical essays on *Ammaia* (which are chiefly based on epigraphical evidence), its territorial extension and its role in communication networks (Mantas 2000; 2010), but it is impossible to ignore the silence of ancient sources regarding this town.³

Systematic archaeological digs have been carried out by the Fundação Cidade de Ammaia since 1994. These excavations were almost all centred on places where visible ruins indicated the underground presence of Roman structures. They were focussed on the parts of the city wall with towers and a gate (*Porta Sul*) on the southern side, with the remains of housing and a monumental paved square and a road in the same sector (Pereira 2009). In addition, there were the remains of a house in Quinta do Deão, parts of a public baths (Borges 2002), and the remains of the centrally located forum with the *opus caementicium* nucleus of the *podium* of a temple⁴ (Carvalho 2002; Mantas 2010; Figure 16.2). These data have been used by Mantas in order to propose an initial reconstruction of the central square: it would have been a fairly rectangular square, surrounded on at least three sides by a *porticus* or a *cryptoporticus*. The existence of a *basilica* on the southern side was thought to be possible but has not been proven (Mantas 2000).

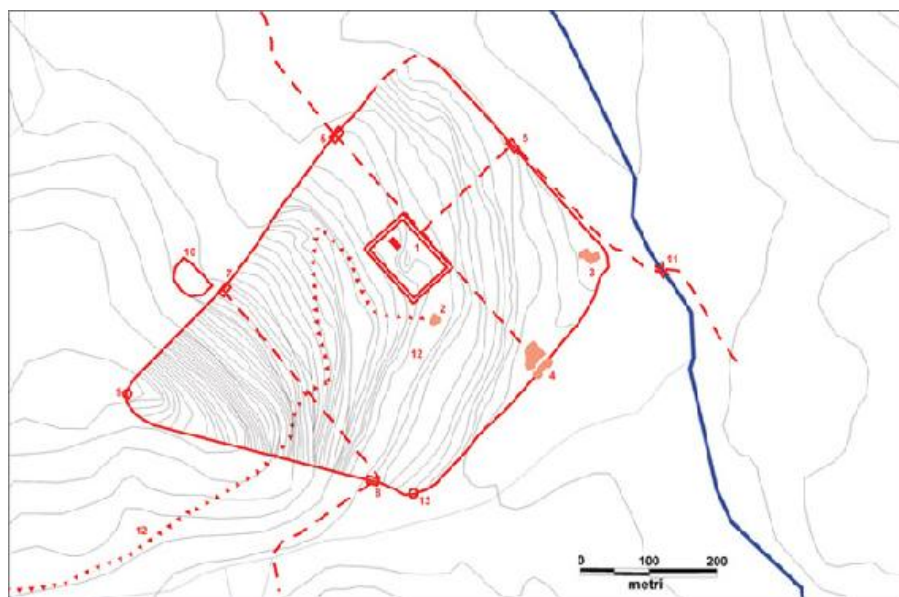


Figure 16.3 Archaeological map of the town before the last field campaigns (2008–2010), with the hypothetical wall circuit, the location of the most important archaeological sites and finds (nos. 1–4), of possible gates (nos. 5–9), the hypothetical trajectory of the aqueduct and the location of the theatre, excluded by further research (elaboration by Corsi and Vermeulen).

An area which has been heavily affected by the construction of a modern

road, where some thermal installations have been noted above the surface of the ground, just outside the southern edge of the forum, was also partially investigated by the archaeologists of the Fundação. What was brought to light here, between 1996 and 2003, were parts of a vast complex, containing one room which was clearly identified as a bathing facility, which was probably heated, and the corner of a well built *natatio*. In between them seems to be a large space in which the floor was probably originally laid on *suspensurae*. However, this area was devastated by robbing activities (Corsi and Vermeulen forthcoming).

Some other excavations (campaigns in 1995 and 2002– 2006) have investigated a portion of the town wall: the southeast corner has been located exactly where a geoarchaeological survey had predicted that the rounded corner of the circuit would be, facing the Rio Sever (Vermeulen *et al.* 2005; Pereira 2009: 99–126).

From 2001 to 2005, several intensive geo-archaeological campaigns were conducted by the Universities of Ghent and Cassino⁵ (Vermeulen *et al.* 2005; Corsi and Vermeulen 2008; 2009; Corsi *et al.* forthcoming; Vermeulen and Taelman 2010).

Since the end of 2007, a new stage of research has been undertaken in *Ammaia* under the direction of the University of Évora: new projects have commenced (see above) and two campaigns of excavation at the Roman baths have been concluded (Corsi and Vermeulen forthcoming), with a third in summer 2010, which focussed on the area of the forum.

Our geo-archaeological survey and the interpretation of the (poor) available historical aerial photographs has allowed us to create a draft of what the wall circuit may look like (Vermeulen *et al.* 2005; Corsi and Vermeulen 2008) and to sketch a basic but regular urban layout, with the presence of at least two street axes detectable in the vertical photography. The northwest–southeast main ‘avenue’, traditionally called *cardo maximus*, obviously departing from the paved square of Porta Sul, and connecting to a possible gate on the other side of the wall circuit, flanked the square on the eastern side of the forum complex (the site map before 2008 is presented in Figure 16.3). A geo-archaeological survey procured very interesting discoveries and acquisitions about the water supply and the exploitation of different resources within the territory. Regarding these areas, however, we refer to the most recent relevant publications (Vermeulen *et al.* 2005; Corsi and Vermeulen 2008; 2009; Vermeulen 2009; Vermeulen and Taelman 2010).

Methodology

The traditional topographical field survey which was intended to collect surface artefacts did not provide good results in *Ammaia*. Despite the fact that the surface once occupied by the town buildings is almost completely free from modern construction, and that the tops of the buried walls appear now

and then on the ground, the invasive presence of pieces of shale, past colluviation and the absence of ploughing activities (the fields are now mostly uncultivated grassland, with many scattered olive and chestnuts trees) are all factors that rendered this approach unproductive.⁶

A more complex and integrated geo-archaeological approach, which was intended to be a combination of traditional archaeological techniques (such as field surveys, aerial photography, historical cartography, archive data geo-referencing and GIS processing) and geomorphology (such as augering and the study of stratigraphic sections) produced very good results.

The assessment and reconstruction of the Roman landscape, which has been greatly altered by the physical movements of the soil and by two millennia of human interference, were the primary objectives in the implementation of the archaeological questionnaire.

The aim of the current projects is therefore essentially to validate an integrated methodology in which geophysics and LiDAR play major roles. The first campaigns, organised in May 2008 and in the summer of 2009, investigated almost four hectares of urban surface with magnetometry and georadar technology, mainly covering the area between the forum and the thermal baths (Figure 16.4).⁷ New extensive campaigns in 2010 ran from June to October (Figure 16.4), while excavations have been carried out in the forum area, which are aimed at ‘ground-truthing’ the temple area and answering some questions regarding the portico sector (Vermeulen *et al.* 2012). In the course of the whole of 2011, the intramural magnetic survey has been completed by Paul S. Johnson for the lower part of the town (a total of 18 hectares, Figure 16.4), while the team of Eastern Atlas has carried out the magnetic survey of several suburban areas. We will write a report regarding these new acquisitions in the very near future.

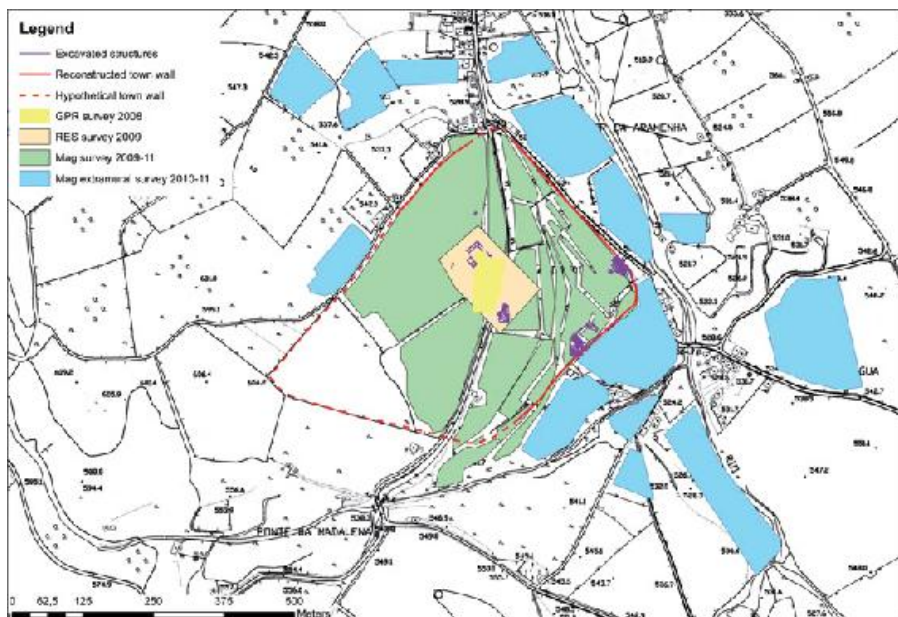


Figure 16.4 Ammaia: areas investigated with georadar (yellow: L. Verdonck, 2008), with magnetometry (green: University of Southampton and P. S. Johnson, 2009–2011; blue: Eastern Atlas, dir. C. Meyer, 2010–2011) and RES and HR magnetometry (ochre: J. Verhegge, 2009) on the base of the modern cadaster and indication of the estimated intramural surface. In purple: excavated areas.

The construction of a very dense and stable ‘web’ of topographical points has also been a necessary step in order to prepare the ground for any further data processing: all of the maps and drawings from former excavations have been digitalised and stored in CAD format and made accessible online via the GIS set up by Devi Taelman, where all of the existing topographical maps and aerial photographs have also been geo-referenced.

Results

The most spectacular acquisitions from the geophysics survey were probably those from the area of the forum. As we have seen, excavations carried out in this location during the years 1995–1997 and 1999–2000 have led to an initial proposal for a possible reconstruction of the monumental centre (see above), which can now be substantially updated. The outside perimeter of the square maintains its rectangular shape, but the dimensions have been shown to be bigger (64.76m wide and more than 88m long) and it is impressively clear from the GPR that two rows of six (?) identical *tabernae* were built in the southern half of the square (Figure 16.5). Both blocks of *tabernae* opened onto a corridor which was probably colonnaded and reduced the width of the open space to approximately 31m. On the opposite side of the temple rose the *basilica*, an elongated rectangular building (c. 45.70 × 17.00m), the interior of which was divided into three unequally wide naves by two rows of columns,

which appear with astonishingly clarity in the GPR processed image. Smaller monuments were scattered around the open space (Vermeulen *et al.* 2012).

The basic grid of the urban street network is now much more tangible and detailed: one street along the western side of the forum paralleled the one on the opposite side (the assumed *cardo maximus*), while two perpendicular streets delimited the area of the monumental centre of the town on the two short sides of the square (Figure 16.6) (Vermeulen *et al.* 2012). It seems likely that the foundation of *Ammaia* was conceived as a regular orthogonal plan of a grid of streets defining rectangular blocks of buildings, whose proportion is approximately 1:2.

The area which has been surveyed up to present, with the exception of these monumental sectors, seems to have been occupied by housing quarters: often rooms of different shapes are displayed in various orders around the open spaces to be interpreted as courtyards. Our first idea, that at least the lowest part of the town was planned with a regular layout, is therefore fully confirmed, while the original idea that these regularly shaped blocks were laid out on artificial terraces, thus compensating for the difference in altitude between the highest point of what has been proposed as an intra-mural surface and the bottom of the slope (total drop 40m, between 560 and 520m a.s.l.), has been abandoned on the basis of the first results of the geophysical survey. As no trace of artificial terracing has so far been detected, the city streets were probably quite steep and did not involve steps.

The integration of the excavation data with the first results of the geophysical survey and the preliminary revision of the huge quantity of archaeological materials collected during the past 15 years in the depot of *Ammaia* has dramatically increased our knowledge of the Roman town. This knowledge can now be summarised as follows.

Ammaia was probably founded in Augustan times, most likely in the early first century AD, while the first document mentioning the *Civitas Ammaiensis* dates back to the rule of Claudius.⁸ The town received its municipal status at an early stage in its development, a fact that we can gather from an epigraphic monument dating back to the reign of Lucius Verus (*CIL*, II, 158 = IRCP, 616). We can assume that the first infrastructures of the town date back to the first decades of the first century AD, including the main gate (*Porta Sul*) and the layout of the urban street network. However, some monumental facilities like the towers and the arched southern gate, with its paved square surrounded by porticoes, are thought to be Flavian or even Trajanic additions (Pereira 2009: 71–72). Preliminary analysis of the data collected in the course of the excavation campaign in 2010 seems to suggest that the first monumentalization of the central area occurred around the first half of the first century AD, with partial restructuring occurring in the early Flavian age.

Fine wares and amphorae (the two groups of materials which have already been consistently processed)⁹ seem to prove that the town flourished during the second and third centuries. Some preliminary studies of building

transformations seem to demonstrate that in the course of the fourth century, few monuments were renovated (Pereira 2009: 120–122, 144–145), while archaeological finds indicate that the town was still active in the Late Imperial phase. After the fifth century, the city seems to have gradually fallen into abandonment, as the inhabited areas gradually shrank: recent excavations have shown that some parts were already covered by floods and slope deposits during Late Antiquity, and that some constructions, presumably private buildings, invaded the public spaces, as seems to have happened along the streets in the northeastern compound. Ancient sources inform us that when the Arabs conquered the region in the last quarter of the ninth century, the Muladi chieftain Ibn Marwân settled on the nearby and strategically well-situated stronghold which was named Marvão after him, and boasted that he was Lord of the '*Fortaleza de Amaia*' (Campos 1963: 111–112). At that time, the Roman site was presumably totally abandoned. At present, no trace of any earlier (Iron Age) occupation has been found, but traces of Neolithic or Calcolithic structures are said to have been found in the course of the excavations inside the building which at present hosts the museum (the Quinta do Deão, Pereira 2009: 130).

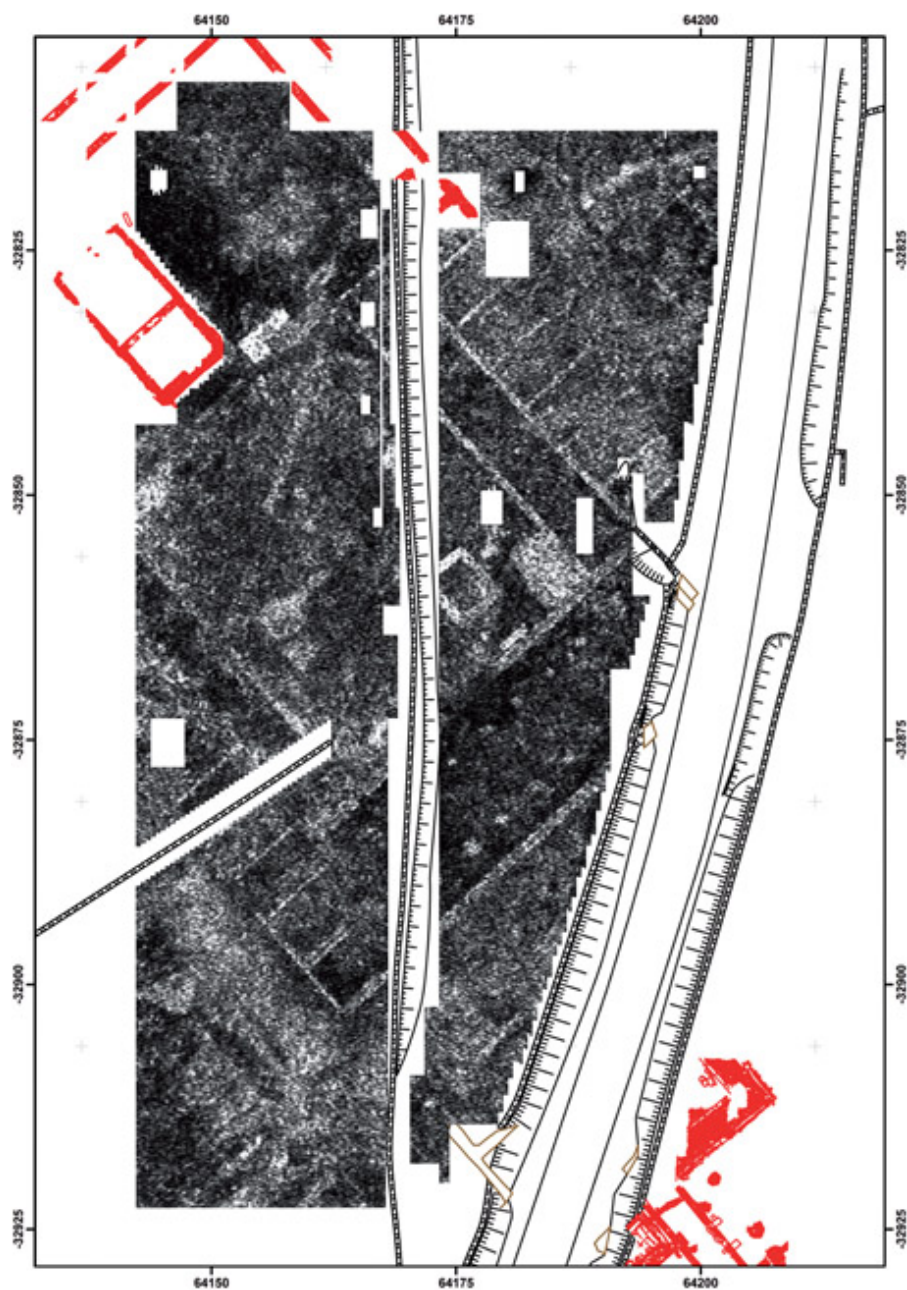


Figure 16.5 Ammaia, the Forum area. In red the archaeological evidence, and in grey scale the GPR survey data interpretation by L. Verdonck (UGent 2008).

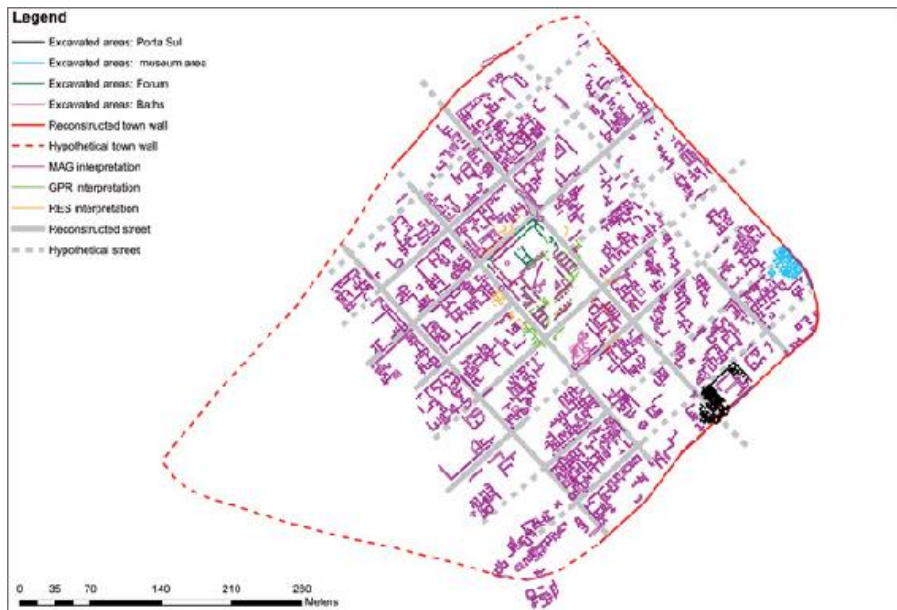


Figure 16.6 Ammaia. Proposal for the urban network in the lower part of the town based on the interpretation of the magnetometry (purple), GPR (blue) and RES (orange) survey. The excavated archaeological evidence is also indicated.



Figure 16.7 Ammaia Museum. Fragment of marble architectural roof decoration thought to be from the forum temple.

Conclusions

The geophysical survey techniques applied in *Ammaia* until now (GPR and magnetometry) have proven to be very suitable for the nature of the archaeological deposits at the site.¹⁰ Nevertheless, the questions left open by the geophysical survey can only be answered by an intensification of the ‘groundtruthing’. In fact, the archaeological stratigraphy has provided us with the opportunity to put to the test the ‘radiographies of subsoil’ obtained with non-destructive techniques, and has also supplied the necessary historical framework. This also tells us about changes that have occurred and supports our reconstruction, even if limits and gaps in our knowledge will be always present. For instance, in the *Ammaia* forum, the lack of information about the location of previous finds and the provenance of *spolia* limits the possibility of sketching the architectural setting and the ideology behind the decorative programme (Figure 16.7).

Our first impression, that the town had a regular layout, has been confirmed, but it is too early to propose a metrical interpretation. The existing knowledge of Roman urbanism in the area is not in-depth, and parallels and comparisons must be searched for across a wide region. For these reasons, ongoing research will mainly examine these aspects.¹¹ In order to fill the gaps in our knowledge of the three-dimensional appearance of the town over the course of time, other approaches will need to be used in tandem with those already being deployed. Interesting developments may arise from an analysis of the vertical stratigraphy of preserved walls, and a richer sampling catalogue of building techniques of the region could help in dating what is still standing above ground.

The perspectives for long term research in *Ammaia* that have been offered to us are now allowing us to delve deeper into the matter of urban surveying and work harder on three-dimensional reconstructions. In fact, both the integrated implementation of non-destructive approaches and a reliable model of the Roman city of *Ammaia* are crucial items on our research agenda.

Acknowledgements

The research leading to these results has received funding from the European Community’s Seventh Framework Programme (FP7/2007–2013) under grant agreement no. 230679, under the action Marie Curie – People IAPP, with the Project entitled ‘Radiography of the Past. Integrated nondestructive approaches to understand and valorise complex archaeological sites’.

Notes

- 1 The Fundação joins the Universidade de Évora, the Fundação para Ciência e Tecnologia (FCT, the Portuguese National Fund for Research), the Municipality of Marvão, the Parque Natural de Serra de São Mamede (the Natural Reserve in whose border the archaeological site is located) and other private and public stakeholders.

- 2 For instance, the IAPP project 'Radio-Past': for details and updates on scientific achievements see www.radiopast.eu.
- 3 For example, Pliny the Elder does not mention *Ammaia* among the centres of *Lusitania* but records the find of a stunning piece of rock crystal from the *Ammaeensis Iuga*: *NH*, XXXVII, 24; cf.: XXXVII, 127.
- 4 Measuring 17.30 × 9.00m (*cella*: 10.5 × 9.0m = 35 × 30 Roman feet).
- 5 UGent: Frank Vermeulen, Morgan De Dapper and later Sarah Deprez; Unicas: Cristina Corsi. The geo-archaeological approach also characterises the doctoral researches of Sarah Deprez (Deprez 2009; Deprez *et al.* 2009) and Devi Taelman (Taelman *et al.* 2009; Vermeulen and Taelman 2010).
- 6 In the very near future, we will report on the different survey strategies adopted in the course of the campaigns in 2010, such as shovel pits.
- 7 The georadar survey was carried out by the team from Ghent University (Lieven Verdonck), while the magnetometry survey, carried out by the same team (Jeroen Verhegge) in collaboration with the University of Southampton (Nicola Schiavotiello, directed by Kris Strutt) was interested in the area in between Porta Sul (the Southern Gate) and the provincial road, the area of the Forum and the sector north of it (Figure 16.4). The GPR survey used the pulseEKKO PRO sensor and software, with a 500 MHz antenna, and was set to a network of 0.25m in distance. The image presented here is a slice with an estimated depth of 0.55–0.60m (Verdonck, Taelman, Vermeulen 2008). The magnetometer survey was undertaken using a Bartington Instruments *Grad601–2* Dual Array Twin Fluxgate Gradiometer. Readings were taken at 0.25m intervals along traverses every 0.5m within 30 × 30 grids (Strutt 2009: 9). Disturbances due to the presence of modern pipelines and excavations, trees and power lines were detected in different areas of the survey, mainly in the southeastern corner of the northern field.
- 8 AD 44 or 45: IRPC, 615. See Mantas 2000: 392–393.
- 9 Post-doc and doctoral research has commenced (with the participation of the Portuguese FCT) in order to study the amphorae (C. P. Venditti), fine wares (J. C. Quaresma) and common wares (V. Dias).
- 10 As emphasised by K. Strutt, 'bearing in mind the sedimentary nature of the building materials used at *Ammaia* a clear response to the technique was not necessarily guaranteed' (Strutt 2009: 9).
- 11 Sara Persichini will investigate these matters in the framework of another post-doc fellowship supported by the FCT.

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The *Burnum* Project: An Integrated Approach to the Study of a Roman *Castrum* in Croatia

F. Boschi and E. Giorgi

Introduction

The *Burnum* Project is an international joint research project between the University of Zadar, the Civic Archaeological Museum of Drniš and the Department of Archaeology of Bologna University, under the aegis of the Centro Studi per l'Archeologia dell'Adriatico (Ravenna, Italy), with the financial support of the Krka National Park and the Ministero per gli Affari Esteri (MAE). The scientific direction is composed by Nenad Cambi, Miroslav Glavčić, Zeljko Miletić (University of Zadar), Josko Zaninović (Civic Museum of Drniš), Enrico Giorgi, Giuseppe Lepore (University of Bologna).¹

The principal aims of the project, started in 2005, are the knowledge and preservation of an important archaeological site in the centre of Croatia, the Roman settlement of *Burnum*, in the valley of the Krka river, inside one of the most significant natural parks of the Croatian region (Krka National Park). This situation grants a strong advantage for archaeology: the opportunity to plan a more integrated strategy for the preservation and valorization of the natural, cultural and archaeological heritage of the area for both enhancement and promotion.

The site of *Burnum*, today called 'šuplja crkva' (ruined church), or 'šupljaja' (ruins), for the remains of Roman arches, is located on the right bank of the river Krka (*Titius flumen* in the historical documents) a few kilometres away from the modern town of Kistanje, in the district of ŠibenikKnin. The geological characteristics of the river, flowing in a deep canyon near the site, made this area the best point for the ford and a strategically extremely important place, also because in the past the river marked the ancient boundary between *Liburnia* and *Dalmatia* (Pliny, *H.N.*, III, 139–140), territories which were respectively friendly and hostile to Rome. This exceptional position of control on the crossing point of the river was also taken advantage of in the pre-Roman age, as demonstrated by the remains of the fortified settlement of Liburnians found on the left bank of the river. The analysis of the archaeological remains shows that the site was

already occupied at the end of the Illyrian campaigns of Octavian (35–33 BC). For the whole first century AD this important strategic area was garrisoned, apart from the legionary based in the *castrum*, also by various auxiliary units settled in one or more fortified camps, the *castella*, close to the *castrum*. In AD 86 *Dalmatia* was declared pacified land (*provincia inermis*). From this moment, the defence of its territory was no more a task of the legions, but of the auxiliary contingents only. The *castrum* of *Burnum* developed firstly as population centre, then, during the second century AD (probably in the Hadrianic era), the centre acquired the juridical form of *municipium*. After the birth of the municipality, the strategic-military control of the area, crucial crossroad of important roads connecting the coast and the inland of the province, was anyway guaranteed by the auxiliary soldiers. The concentration of inscriptions of beneficiaries to consular officers in *Burnum* witnesses, once again, that the former settlement remained an important administrative and military centre of *Dalmatia* in the second–third century AD. The municipality had a significant role until the Late Antiquity. Notwithstanding this, the Gothic-Byzantine war, which involved in its last phase various centres of the northern inland territories of *Dalmatia*, resulted in AD 536–537 in the elimination of *Burnum* from the historical stage (Procop., *Goth.*, I: 16).

The main limits of the Roman *castrum* are recognizable also in some elements of the modern landscape and today the only evidence still visible at the site are two arches made of blocks of local stone standing on a nearly plain, which are the only remains of the forum *basilica*, and a substantial amphitheatre, recently excavated and restored by the University of Zadar and the Museum of Drniš (Figure 17.1).

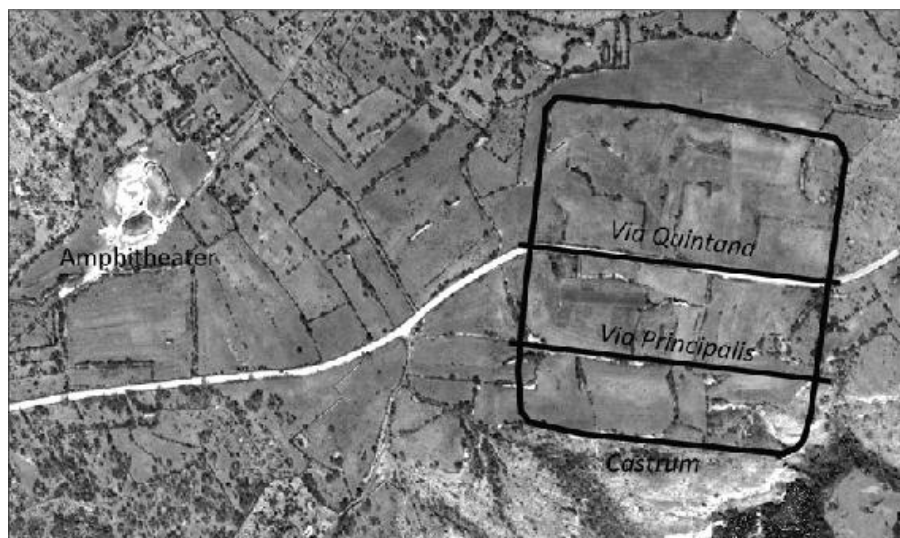


Figure 17.1 Aerial view of the site of Burnum.

State of the art

Before the new research, the information we had about the site was almost exclusively related to the area of the *forum* and the *basilica*. In the past, the progressive degradation of the remains of the *fora basilica*'s arches had been described by important personalities, as the Venetian abbot Alberto Fortis, in his *Viaggio in Dalmazia*, issued in 1774, and, after almost a century, by Theodor Mommsen.²

Successively, this part of the ancient city has been investigated by the Austrian Archaeological Institute of Vienna, from 1912 to 1913 and between 1970 and 1971.³

Since 2003 the archaeologists of the University of Zara in collaboration with the Museum of Drniš have commenced the new archaeological research at the amphitheatre, which was probably built during the reign of Claudius.⁴ The large building (130 × 117m) presents an arena of 50 × 47m, four entrances and access stairs for the steps and the arena itself. The discovery of a stone monumental inscription, found by the southern door, describing the name of the Emperor Vespasian and dated AD 76–77, allows us to speculate on a possible extension of the constructions during those years.

Recently, the attention paid to the city of *Burnum* was converted into a wider Italian-Croatian partnership project and ratified by an agreement (drawn up in August 2005) between the Civic Archaeological Museum of Drniš, the University of Zadar and the University of Bologna.

The *Burnum* Project has been started with the aims of acquiring knowledge and enhancing the preservation of the site and its context. At this moment, new research concerns the southern part of the settlement and a sector of the northern part, where a large and integrated geophysical mapping and some pointed archaeological excavations have been carried out. Another important aspect of this project is the education of young students and researchers. In fact, in 2007 *Burnum* hosted the first event of the International Summer School *Seeing Beneath the Soil* of Bologna University and since 2009 it has become a field school for the 'Specialization School in Archaeology' of Bologna.

Methodology

From the beginning of the *Burnum* Project, great importance has been given to non-invasive methodologies for archaeology. The research is focused on different scales of analysis: on a microscale, it regards the main preserved evidence of the *municipium*, the remains of the *fora basilica* (the arches), and, on a large scale, it concerns the study of the whole settlement and its environment.

For the analysis of the arches, we have combined the study of the old archive documents with the application of modern systems of topographical survey, like photogrammetry and laser scanning, in order to arrive at the most

precise diagnosis for the restoration of the monument.⁵

On the large scale, after carrying out an accurate historical and topographical study of the context,⁶ we collected and analysed a number of air photographs which revealed the presence in the current landscape of original outlines of the Roman *castrum*, in particular in the modern allotment fields.

Since 2005, different geophysical techniques have been used on the site (magnetometry, electrical resistivity studies and GPR), making the area an interesting case of a multidisciplinary approach applied to urban archaeology (Figure 17.2).⁷ The site has been analysed thanks to the team of Groma, from Bologna University, and with the collaboration of many institutes and research centers, both Italian and foreign.

The characteristics of the area, in particular related to the presence of modern stone wall boundaries which split the site causing frequent gaps in its geophysical mapping, have encouraged us to work in an intensive manner, integrating more survey methods to increase the knowledge of the archaeological record. We have also combined the geophysical techniques with kite photography, especially when studying the unaccessible areas.⁸

After a first positive test carried out at the beginning of the project (August 2005) through the radar system (GSSI, SIR-2 system, with an antenna operating at 500 Mhz), the participation in the successive programmes of many institutes and research centres, allowed us to extend the geophysical survey by an integrated use of different instruments. During the following survey we also tested a georadar Ramac Mala GeoScience equipped with an antenna operating at 250 MHz, a gradiometer GEM Systems Overhauser GSM-19, an ARP (Automatic Resistivity Profiling) system and an OhmMapper system. By the integration of these different methods and systems, the geophysical mapping of the southern part of the *castrum* has been almost completed. Since 2009 we have started the survey of the northern part using an optically pumped Potassium gradiometer (GEM Systems GSMP-35), with a configuration revised by us to increase the control on the sensors during the data acquisition and bring the sensors closer to the topsoil, with a vertical sensors distance of 1.50m.

The measurements were performed over regular grids, with meandering acquisition, georeferenced by means of a Total Station and a GPS system. The georadar investigations have been realized under a 50cm resolution, while for the magnetic survey the acquisition has been carried out continuously (survey mode, walk grad) along profiles set at a distance of 1m one from the other, with a medium sampling space between each measurement of about 35cm (for the Overhauser system) and about 10cm (for the potassium system).



Figure 17.2 Geophysical survey techniques tested at Burnum. From the upper left corner: GPR survey (GSSI system); Ohm Mapper system; Optically pumped Potassium Gradiometer; ARP system; GPR survey (RAMAC system).

On the basis of the geophysical survey results, several archaeological investigations of sample areas have been realised, in order to define functions and chronology of some anomalies recognised as buried structures or buildings, resolve archaeological issues related to the principal phases of the settlement, and verify the instrumental responses of the different systems of non-invasive analysis. The excavations allows us to better understand the geophysical maps and to extend the interpretation proposed for the areas verified by archaeological excavation to other large parts of the site, just covered by geophysics. In this perspective, geophysics are a significant contributor and complement the excavations and are not just a method for guiding in the selection of excavation areas.

Integration has been the basis of each activity, both during the survey planning phase, with a continuous reference to the previous documents (archive data, air images, excavations, etc.), and during the executive phase, combining step by step the results of the geophysical survey with the new aerial photographs, the topographical survey (differential GPS and laser scanning), the analysis of the building materials, in order to establish the best strategy for the new excavations and the restoration of the arches. The support of all specialists involved has been fundamental for the interpretation of the data obtained.

Results

From all the geophysical methods employed, we have noticed a sharp contrast between the physical properties of the buried targets and the surrounding soil.

We started our research in the fields immediately to the north and south of the arches, the areas of the *basilica* and the *forum*, with the principal aim of verifying and positioning the documentation produced by the Austrian archaeologists at the beginning of the last century. We have carried out the survey using the ARP system, and an Overhauser gradiometer, configured with a vertical sensor distance of 1m, and a georadar system, testing different frequency antennas (500 and 250 MHz). The overlapping of the data coming from the geophysical survey and the excavation documents allows us to complete the plan of the *basilica* and the *forum* and to refer some of the geophysical evidence to the eastern side of the *principia* and of the *tabernae*, never excavated before (Figure 17.3). The time-slices obtained and the radar profiles acquired with the 500 MHz antenna reveal a better resolution of the radar reflections, in particular, those reflections produced by targets of small to medium size, but also the data collected with the 250 MHz antenna clearly shows the same main evidence as on the slice-maps.

The direct exploration by archaeological excavation of a small selected part of the area, has precisely confirmed the geophysical anomalies, helping us in the interpretation of some of the radar reflections visible on the radar profiles.

The research carried out with the ARP system, after an intense summer shower which notably increased the ground conductivity, creating the most favourable conditions for this kind of application, have confirmed the presence of structures related to the basilica, and also allows us to extend the survey in a western direction, recognizing other likely wall structures with a north-south orientation and part of the western walls of the *castrum*.

The area south of the *forum* has been transformed into an authentic test site, where we have tested all the methods available. All the instruments clearly show the presence of buried structures, maybe referring to buildings with a residential function and probably related to the municipal period of the site, when the military barracks were replaced by other kinds of buildings.

The ARP maps and the slices radar indicate that the structures are quite superficial, around 50cm depth, and that they survive in height for just 60-80cm (Figure 17.4).

After a first test with the Overhauser gradiometer, during the last survey we also tested the optically pumped Potassium gradiometer, with a vertical sensors distance of 1.50m. The potassium system turned out to be very useful for archaeological prospection, for adequate sensitivity and measuring speed. On the magnetic maps it is possible also to read some details which have never been seen before, with the other systems, as for example, a little apse and some pointed anomalies, maybe related to filled pits.

The integration of the geophysical survey with the topographical survey, realized by a GPS system, has also revealed a sharp congruence between

some of the geomagnetic anomalies and the trend of the surface of the field. The excavations carried out in two points of the field, selected on the basis of the geophysical survey results, have confirmed the evidence and have also shown that the buried structures are built of limestone, corresponding to the instrumental responses of the geomagnetic survey (Figure 17.5).

It could be supposed that the same characteristics might also be found in the area immediately to the east, where the potassium gradiometer, has revealed the presence of a building complex constructed around a central open space, also confirmed by the aerial photography (Figure 17.6). With regards to shape and characteristics, this building could also be related to the municipal period of the centre.

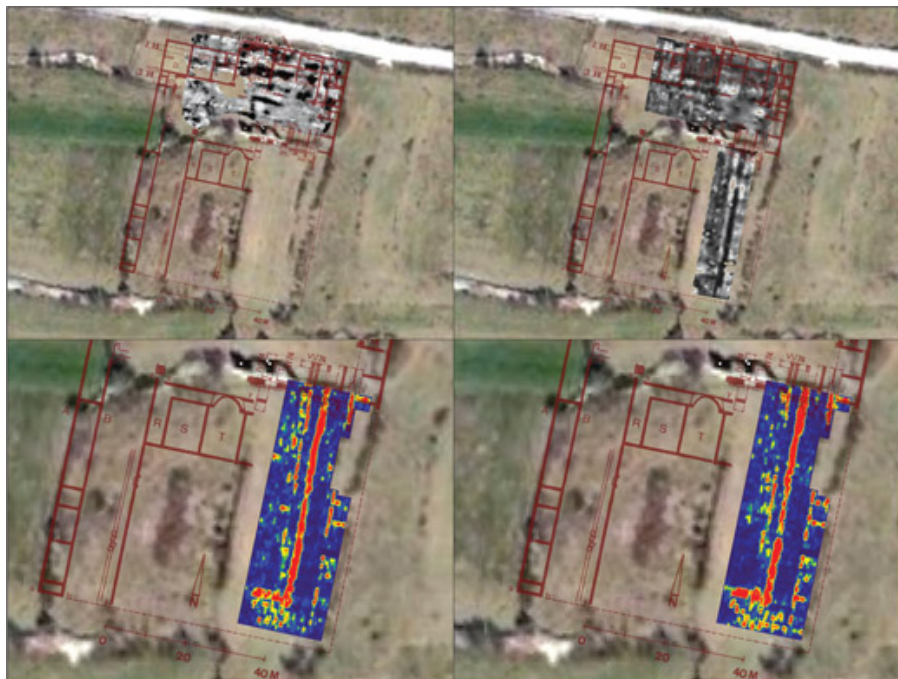


Figure 17.3 Forum and basilica area: overlapping of the geophysical data and of the excavations plan (Austrian Archaeological Institute, Vienna). From the upper left corner: ARPs data; Overhauser gradiometer data; GPR data, 500 MHz antenna; GPR data, 250 MHz antenna.

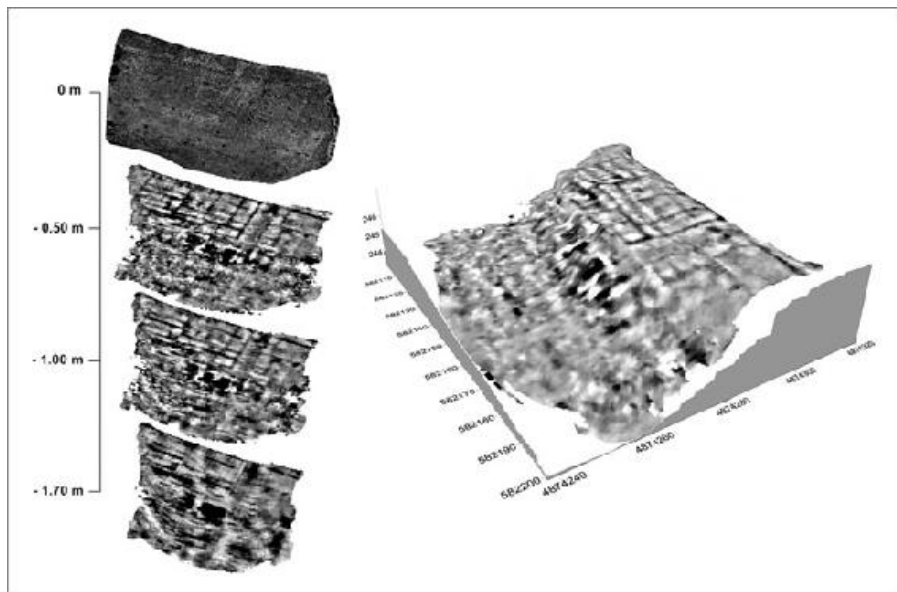


Figure 17.4 Area south of the forum. Aerial photography and ARPs maps relating to different depths of investigation. In collaboration with Geocarta© (Paris) and So.Ing (Livorno).

Outside the limits of the *castrum*, we have started to survey an area of regular shape, where the results obtained by the ARP system are very interesting. The data clearly shows a large built-up area which presents a concentric system of four belts, alternatively conductive and resistant, which, in our opinion, could be interpreted as part of an auxiliary *castrum*, surrounded by a sequence of ditches (Figure 17.7). In fact, a possible comparison would be the Roman *castrum* of Ruffenhofen in Germany, surveyed by Helmut Becker, which shows similar characteristics and a similar sequence of ditches (Becker 2001; 2009).

The main news of the last survey (May 2010) concerns the mapping with the potassium gradiometer of several fields in the northern part of the settlement. From the new magnetograms we can derive some important information about the ancient road system and the urban setting, also confirmed by the recent archaeological excavations carried out in two selected areas.

Conclusions

The understanding of an ancient urban setting cannot be accomplished today without non-destructive survey integrated through a rigorous methodology. Thus, significant results for the study and knowledge of the archaeological record at *Burnum* have been obtained.

The integrated diagnostic approach used at *Burnum* allows us to collect much useful information in order to plan a correct strategy for research and development of the site. The synergy between the several institutions and

researchers involved is, of course, one of the main reasons of success of this project. The non-invasive methodologies of analysis (geophysics and aerial photography) led us to redraw extension and internal texture of the city, assuming some elements never before understood (Figure 17.8).

Thanks to the air photographs, it was possible to confirm the urban confines (the walls surround the settlement on three sides, while the southern one is delimited by the river canyon), the main internal setting and some extra-urban buildings, as the amphitheater and the *castella*. From this point of view, *Burnum* represents an exceptional case of persistence of the ancient limits in the modern stone-wall boundaries.

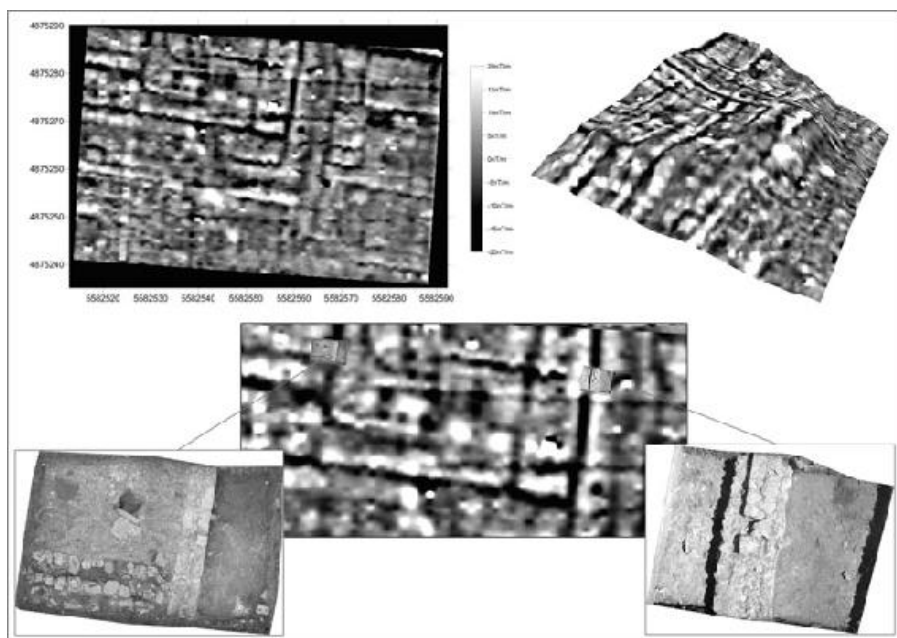


Figure 17.5 Area south of the forum. Optically pumped Potassium Gradiometer data. From the upper left corner: vertical gradient map; overlapping of the gradient map on the DTM; verification of some anomalies by archaeological excavations and results.

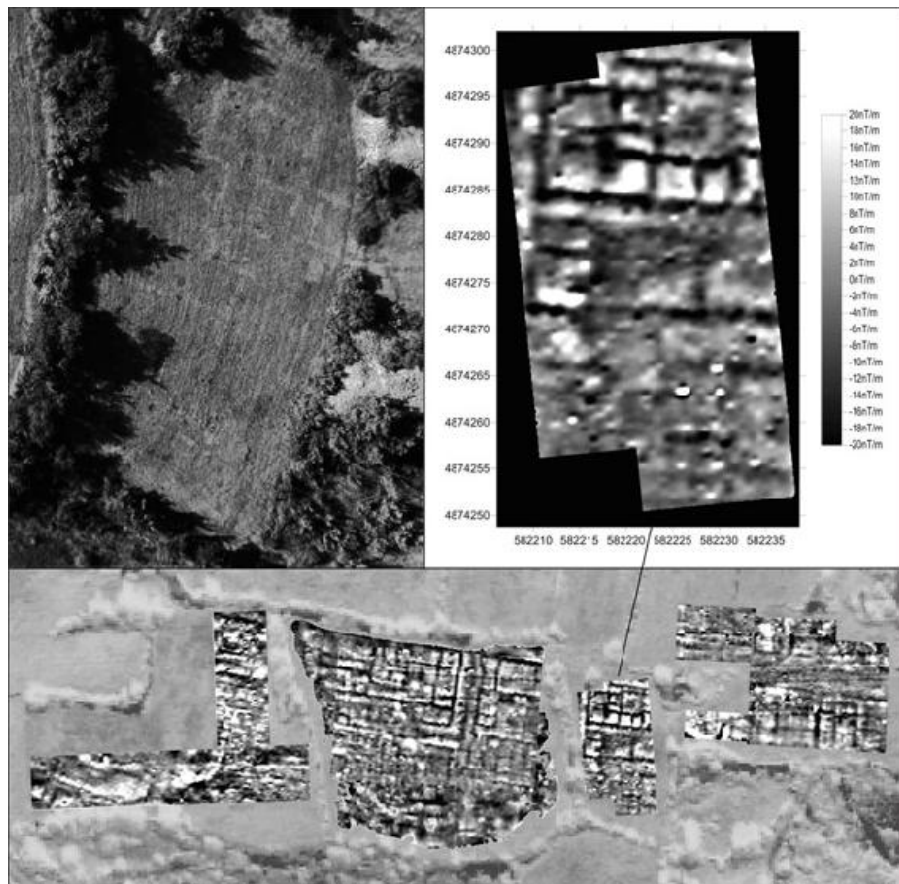


Figure 17.6 Building complex identified by the aerial photography and the geophysical survey (Potassium gradiometer data).

Thanks to the geophysical survey, a possible second auxiliary *castrum* was discovered outside the western border of the settlement. This auxiliary *castrum* is oriented on the road that leads from the town westwards, and given the topography this is probably an earlier routeway. Instead, the modern street, which should correspond to the ancient Roman road, seems to have adapted itself to the main *castrum*. The site turned out to be very useful for the geophysical applications, thanks to geological and physical properties of the soil, and also to the characteristics and the limited depth of the buried evidences.

The stratigraphical archaeological excavation, although little used, allows us to arrive at more chronological details.

At the present stage of a work in progress, we have identified five main chronological phases of the settlement:

- 1 Foundation of the *castrum* (at the end of the first century BC) over an area which presents traces of previous occupations and the remains of a pre-roman material culture;

- 2 Monumental expansion of the military *castrum* and construction of the *principia* (first century AD);
- 3 Urban development of the *municipium* and abandonment of the *castrum*. The auxiliary troops settle outside the urban walls (first to second century AD?);
- 4 Birth of the *municipium*, during Hadrian's reign, and building of the *forum* (second century AD);
- 5 End of the site, probably caused by the Gothic-Byzantine war (sixth century AD).

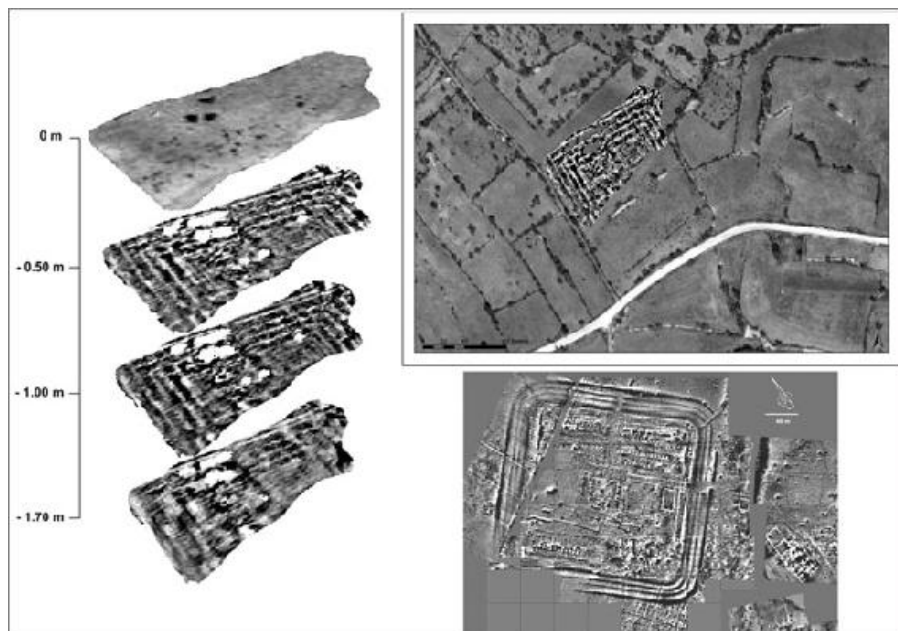


Figure 17.7 Field outside the western side of the castrum. The ARPs maps show a large area with a sequence of ditches interpreted as part of an auxiliary castrum. A possible comparison, the castrum at Ruffenhofen (Germany) is shown bottom right (Becker 2001; 2009).

Thanks to the integration of geophysics and archaeological excavation we have also noticed a different urban stratification at north and south of the ancient *via principalis* of the *castrum*. In fact, the northern part presents a complex concentration of building structures, often overlapping each other, related to several phases of the settlement. During the last survey (2010) part of one of the ancient roads with north-south orientation has been discovered. The road presents a gravel carriageway, with lateral drains and *crepidines*. The discovered path could not be the oldest level of the road. In the southern part, instead, the oldest stone wall structures related to the *municipium* are directly set on the levels of the *castrum*, maybe characterized by perishable materials. The latest phases are not attested, perhaps because they are not preserved. These differences between the northern and the southern part are

probably due to the trend of the topsoil, which slopes gradually to the river canyon. It is also possible that the area north of the *principia* was occupied by military barracks, perhaps built on stone foundations.

Finally, other important findings concern the *forum*, which filled the area of the *principia* of the *castrum*. Its stratigraphies, already explored by the Austrian archaeologists, can, thanks to the new studies now be seen to be much more complex and articulated.

In conclusion, working with the aim to understand the dynamics of settlement and its surrounding transformation from the pre-Roman age to Late Antiquity, we are now better placed to give some first answers to the following questions:

1. the genesis of the town: the *municipium* of *Burnum* developed on top of the ancient *castrum* abandoned by the military legions. This fact advises us to better understand the transformation process which led from the military *castrum* to the town;
2. the end of the town: after the Gothic War the towns seems to fall out of use. Why was it never re-occupied? Perhaps the characteristics that made it appropriate for the settlement, in the sixth century had failed. Evidently this plateau, which had for several centuries a strategic importance, was no longer functional to the geography and history of its territory.



Figure 17.8 State of the art of the geophysical mapping at Burnum. The box shows a particular of the western wall of the *castrum* with its ditch identified by the magnetic survey (May 2010).

Notes

- 1 Field direction: Alessandro Campedelli (archaeological excavation), Federica Boschi (geophysical survey), Michele Ricciardone (restoration). The scientific institutions involved are: Centro Studi per l'Archeologia dell'Adriatico (Giuseppe Sassatelli, Federica Guidi); Dipartimento di Ingegneria Meccanica e Civile, University of Modena and Reggio Emilia (Alessandro Capra, Marco Dubbini); Dipartimento di Ingegneria dei Materiali e dell'Ambiente, University of Modena and Reggio Emilia (Federica Bondioli, Maria Elena Darecchio); Dipartimento di Architettura Costruzioni e Strutture dell'Università Politecnica delle Marche, University of Ancona (Stefano Lenci, Enrico Quagliarini, Quintilio Piattoni); INGV – Istituto Nazionale di Geofisica e Vulcanologia, Rome; Geocarta soc., Paris (Michel Dabas); So. Ing. Livorno (Gianfranco Morelli, Giovanni Bitella); LAPeTLAB – Laboratorio di Archeologia dei Paesaggi e Telerilevamento, University of Siena (Stefano Campana, Barbara Frezza, Maria Elena Ghisleni); CGT – Centro di GeoTecnologie, University of Siena (Fabio Mantovani, Marta Bottacchi); DISTA (Dipartimento di Scienze e Tecnologie Agroambientali – University of Bologna (Paola Rossi Pisa; Marco Bittelli).
- 2 Baratta 2005.
- 3 Kandler 1976–1977: 39–45; Zabehlichy Scheffenegger and Kandler 1979.
- 4 The hypothesis that the *castrum* of *Burnum* had an amphitheatre had already been proposed in the 1930s. Researchers like Bulić and Marun thought in fact that the elliptical sinking delimited by a large heap of stones, present in the south-western area of the site, could hide its remains. Since no surveys had been carried out, there was no reliable evidence of its existence until 2003, when, after having eliminated the vegetation covering the structures, the rests of the southern entrance of the amphitheatre were found. The excavation and documentation works, patronised by the Direction of the Krka National Park, are being carried on and will take probably another couple of years.
- 5 The new restoration has been carried out during the 2009 by Michele Ricciardone (Professional Restorer) and with the help of Alessandro Campedelli (see Ricciardone 2009).
- 6 This part of the research has been carried out by Alessandro Campedelli (Ph.D. candidate at the University of Bologna). For the *Burnum* Project please see Campedelli, Vecchiatti 2009; Campedelli *et al.* 2007; Cambi *et al.* 2007.
- 7 The geophysical survey has been realized thanks to the collaboration with Michel Dabas (Geocarta, Paris), Gianfranco Morelli, Giovanni Bitella (So. Ing. Livorno), Iacopo Nicolosi (INGV, Rome), Stefano Campana, Barbara Frezza, Mariaelena Ghisleni (LAPeTLAB, University of Siena), Marta Bottacchi (CGT, University of Siena), Paola Rossi Pisa, Marco Bittelli (DISTA, University of Bologna). About these arguments see Boschi and Nicolosi 2009; Dabas 2009; Boschi and Campedelli 2008.
- 8 The kite photographs have been realized thanks to an instrument developed by Michele Silani (Specialization School in Archaeology, University of Bologna), which consists of a static kite and remote controlled *picavet* clicking system. For this angle of study, see Silani 2009; Cambi *et al.* 2007: 54–55; Campedelli *et al.* 2006: 134–135.

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PART 2: INTER-URBAN RELATIONSHIPS

Urban Archaeology, Urban Networks and Population Dynamics in Roman Italy

L. de Ligt

Introduction

Until a few decades ago almost all archaeological research undertaken in urban areas was done in the topographical tradition, one of whose aims was to reconstruct the layouts of Greek and Roman towns by mapping all surviving traces of ancient buildings, including those brought to light during excavations. It was only in the late 1970s and early 1980s that attempts began to be made to investigate the size of ancient towns and their evolution over time by surveying free-lying urban sites. In Greece this technique was pioneered by Antony Snodgrass and John Bintliff who initiated an impressive series of urban surveys at the sites of the Boeotian towns of *Haliartos*, *Hyettos* and *Thespieae* (e.g. Bintliff and Snodgrass 1988a; 1988b). From these surveys some very important results emerged. For instance, when the new data concerning the size of the Boeotian towns was combined with rural survey data, it appeared that, at least in classical times, about 80% of the population must have lived in towns – a strikingly high figure.¹ Interestingly, the ceramic evidence collected during the urban surveys also made it possible to chart changes in town size between classical and Roman times. One illustration is provided by the town of *Thespieae*, which contracted from about 95ha in the fifth and fourth centuries BC to approximately 72ha in late Hellenistic times and 40ha during the early Roman Empire (Bintliff 2004: 211). This finding seems to support the traditional view that the Hellenistic period marked the beginning of a long phase of demographic contraction in at least some parts of the Greek mainland.²

From the late 1970s urban surveys were also carried out in Italy. I refer here to the pioneering work of John Hayes and Peter Martini at *Interamna Lirenas* and to Gert-Jan Burger's dissertation on the pre-Roman and Roman Salento. In recent years the number of urban surveys carried out in Italy has continued to expand. Another important development has been the investigation of large areas with the help of ground-penetrating radar and measurements of electromagnetic conductivity. Notable examples of what can be achieved by the application of various urban survey techniques are the

British projects at *Falerii Novi* and *Capena* and the survey campaigns carried out by Prof. Heizelmann and his teams at Ostia and *Amiternum* (Keay *et al.* 2000; 2006; Heinzelmann and Jordan 2007). Many further examples can be found in this volume.

It seems possible to conclude that urban survey has become one of the most flourishing sub-disciplines in Italian archaeology and that spectacular results have been achieved. However, so far few attempts have been made to use these results to build up or to update reconstructions of urban systems at a regional scale. Yet there can be little doubt that this is a promising avenue for enquiry. More than 20 years ago Tønnes Bekker-Nielsen pointed out that enormous variations in average inter-city distances can be observed between and within the 11 Augustan ‘regions’ (Bekker-Nielsen 1989; cf. De Ligt 1991: 54–55). This simple observation suggests that late republican and early imperial Italy had a variety of urban networks each of which displayed some region-specific characteristics. Since these regional systems cannot be reconstructed on the basis of urban survey evidence alone, we must obviously combine this type of evidence with the results of older and more recent work which was done in the topographical tradition.

In what follows I shall also try to examine the steadily growing body of archaeological evidence for the size and historical evolution of the towns of Roman Italy in the light of the ongoing debate about population numbers and levels of urbanization in late republican and early imperial Italy. Of course I am not suggesting that the archaeological data available at present can be used as a base for precise population estimates. As we all know, most or all approaches of this type are fraught with enormous methodological difficulties.³ However, even if this fundamental problem is acknowledged, it remains an interesting question whether the archaeological evidence for the size of towns matches the predictions of any particular reconstruction of Italian population levels. In other words, even where purely inductive methods fail us, we can still explore the degree of fit between competing models and the indications supplied by topographical studies and urban surveys.

Regional urban networks in Roman Italy

In studies dealing with towns and urban networks in medieval and early modern Europe ‘towns’ are often defined as large agglomerations most of whose inhabitants do not grow their own food (e.g. Hohenberg and Lees 1985: 17). As John Bintliff and Mogens Hansen have shown, this definition is not particularly helpful in the case of classical Greece, where a high proportion of the farming population lived in urban centres (Bintliff 1997; Hansen 2006). For late republican and early imperial Italy, where most farmers lived in the countryside, the conventional view of what distinguishes a town from a village is less problematic, although we can be sure that here

too some town-dwellers were primarily engaged in agrarian occupations (cf. Garnsey 1979; 1998).

Another question is how large a 'large agglomeration' must be to qualify as a town. On this question the existing literature is hopelessly divided. In his famous study of urbanization in late medieval and early modern Europe Jan de Vries excluded all agglomerations having fewer than 5000 inhabitants from his investigations, regardless of the legal status and the occupational structures of these smaller centres (de Vries 1984: 58). Against this approach it has been pointed out that, throughout European history, many smaller agglomerations performed vitally important 'urban' functions for the surrounding populations, so that even habitational nuclei with 1000 or 500 inhabitants could be 'towns' from a functional point of view (e.g. Musgrave 1995; Epstein 2001). In countless publications dealing with the towns of Roman and post-Roman Europe it has also been noted that the juridical status of nucleated settlements tended to affect the occupational structures of their populations and therefore to set them apart from 'villages'. In other words, those settlements which were 'towns' in a juridical sense were also far more likely to be 'urban' from a functional point of view (e.g. Musgrave 1995; Epstein 2001).

In this section I offer a brief analysis of the urban networks of three districts of early Augustan Italy in which all agglomerations that were towns in a juridical sense have been included. However, in order to shed some light on region-specific peculiarities, I have assigned all agglomerations which meet this definition to three subcategories on the basis of their physical size. The first of these categories comprises all towns whose built-up area is likely to have been larger than 40ha; my second category includes all towns which had 20–40ha of built-up space; my third category is made up of all agglomerations which were towns from a juridical (and probably also from a functional) point of view but covered less than 20ha.⁴

At the risk of stating the obvious, I would like to emphasize that the built-up area of a town could be either larger or smaller than the area enclosed by the town wall. In some cases topographical studies or data derived from urban surveys can be used to estimate the size of those areas which were occupied by private or public buildings. In other cases we have to rely on other indications, such as the presence of large theatres or amphitheatres. There is no need to explain why the seating capacity of these buildings cannot be used to estimate the size of urban populations. At the same time it remains a reasonable supposition that large theatres and amphitheatres were mostly erected in or near larger population centres.⁵ In short, even if the presence of these buildings cannot be used as a basis for any precise demographic conclusions, they do provide us with a reason for thinking that the towns in question are unlikely to have been completely insignificant. In other words, they help us to determine whether we are dealing with a large, a medium-sized or a small town. This is enough for my purposes, since my aim is to give

a rough idea of the general shape of urban networks on a regional level rather than to offer detailed estimates for individual towns.

I begin with the towns of *Campania* which have attracted a lot of attention from the late nineteenth century (Figure 18.1).⁶ Although it would be absurd to claim that the sizes of all or most Campanian towns can be assessed accurately, the archaeological evidence is good enough to make possible a rough delineation of the urban network of this region. In my view, it must have looked more or less as follows:

11 large towns: *Atella*, *Cales*, *Capua*, *Cumae*, *Neapolis*, *Nola*, *Nuceria*, *Pompeii*, *Puteoli*, *Suessula*, and *Teanum*. 8 medium-sized towns: *Abella*, *Abellinum*, *Allifae*, *Forum Popilii*, *Herculaneum*, *Salernum*, *Surrentum*, and *Venafrum*. 10 small towns: *Acerrae*, *Caiatia*, *Calatia*, *Cubulteria*, *Liternum*, *Picentia*, *Telesia*, *Trebula Balliensis*, *Urbana*, and *Volturnum*⁷

Despite the methodological difficulties referred to above, there can be no doubt that more than one third of those Campanian settlements which were towns in a juridical sense covered more than 40ha. The biggest town belonging to this category was *Capua* which seems to have covered c. 200ha in the early years of the Principate. This would have made *Capua* the second-largest city of early imperial Italy in terms of physical size and probably also in terms of population. What is also striking is that *Campania* possessed no fewer than eight other large cities whose built-up areas covered more than 60ha.⁸ In terms of their physical size these cities were far larger than the average town of early imperial Italy.

Another distinguishing feature of the urban system of *Campania* is that its towns were closely set. According to the calculations of Bekker-Nielsen average inter-city distances in this part of Italy were as low as 11km.⁹

Although I am pessimistic about the possibility of deriving reliable population figures from archaeological data, it seems clear that the existence of so many large and medium-sized towns in a relatively small area implies a large population. In fact, it is difficult to avoid the impression that, if we ignore Rome, *Campania* was the most densely populated part of early imperial Italy. The obvious explanation is that the exceptional fertility of the Campanian soil made it possible to produce large surpluses which were used to feed a large urban population. While the agricultural tasks which had to be performed to produce these surpluses obviously required a large rural workforce, it seems likely that urbanization rates in this particular region were much higher than the average Italian rate.¹⁰

I now turn to the urban system of the fourth Augustan region (Regio IV), which comprised *Samnium* and *Sabinum* (Figure 18.2). As in the case of *Campania*, the archaeological data for these areas are far from perfect. Nonetheless it seems possible to conclude that *Samnium* and *Sabinum* did not possess a single town whose built-up area covered 40 or more hectares in the time of Augustus. It is true that the remains of *Amiternum* in the eastern part

of *Sabinum* cover some 60 or 70ha, but as we shall see below, the expansion of this town was a development of the first century AD.¹¹

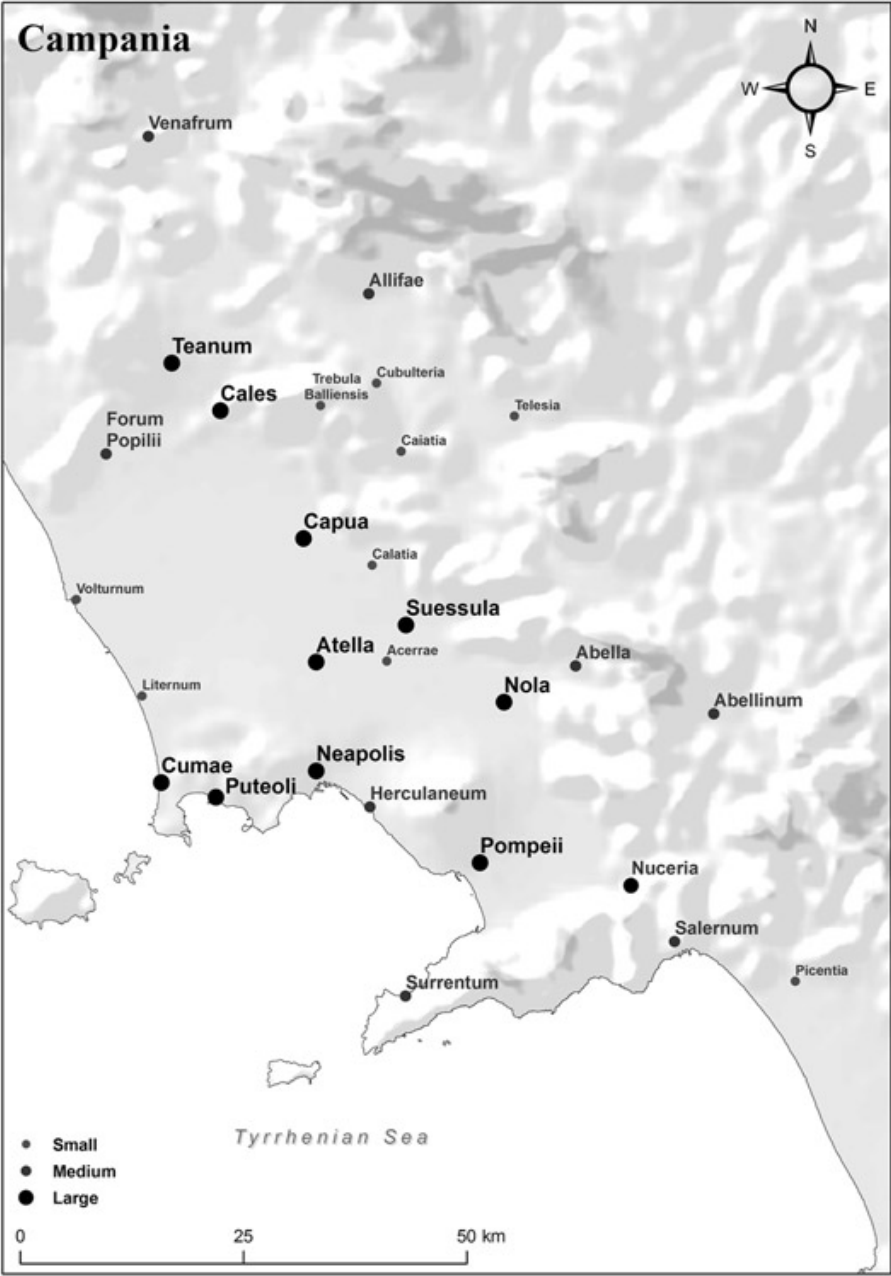


Figure 18.1 Self-governing towns in Campania in the time of Augustus.

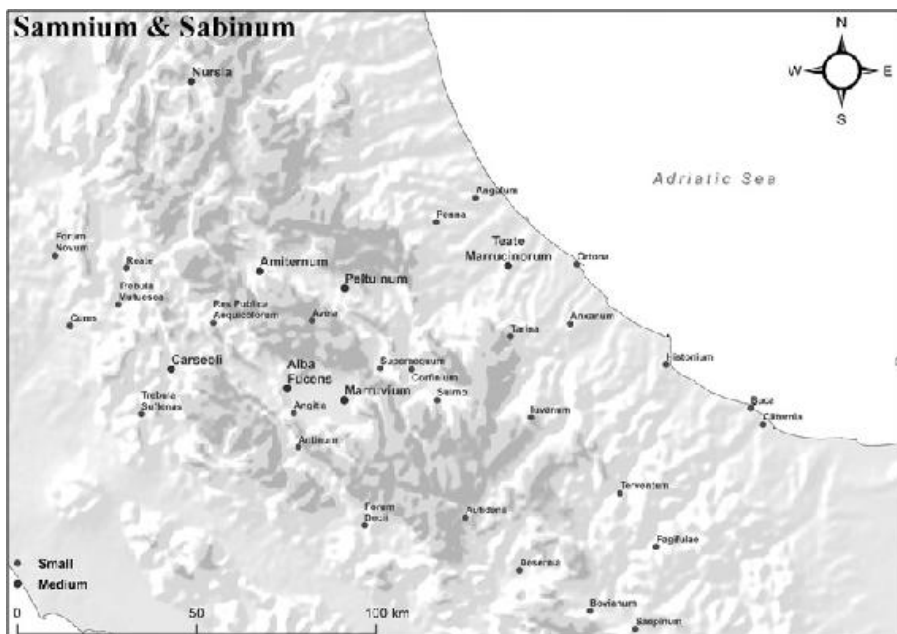


Figure 18.2 Self-governing towns in Samnium and Sabinum in the time of Augustus.

If my interpretation of the archaeological evidence is accepted, the urban network of *Samnium* and *Sabinum* must have looked approximately as follows in the early years of the Principate:

7 medium-sized towns: *Alba Fucens*, *Amiternum*, *Carseoli*, *Marruvium*, *Nursia* (?), *Peltuinum* (?), and *Teate Marrucinorum*.

30 small towns: *Aesernia*, *Angulum*, *Antinum*, *Angitia*, *Anxanum*, *Aufidena*, *Aveia*, *Bovianum*, *Buca*, *Caretia Supernas*, *Caretia Infernas*, *Cliternia*, *Corfinium*, *Cures*, *Fagifulae*, *Forum Decii*, *Forum Novum*, *Histonium*, *Hortona*, *Iuvanum*, *Penna*, *Reate*, *Res Publica Aequicorum*, *Saepinum*, *Sulmo*, *Superaequum*, *Tarina*, *Terventum*, *Trebula Mutuesca* and *Trebula Suffenas*¹²

It is immediately apparent that, quite unlike *Campania*, the fourth Augustan region was an area where the vast majority of all towns covered fewer than 20ha. In fact, the average size of those towns whose built-up areas can be estimated is only 10.8ha.¹³ Since most archaeological investigations have focused on the larger centres, this figure would probably become significantly lower if we had more information.

At the same time average inter-city distances in *Samnium* were considerably larger than in *Campania*. For the northern part of Regio IV Bekker-Nielsen has calculated an average inter-city distance of 15.8km; his figure for southern *Samnium* is 22.8km (Bekker-Nielsen 1989: 25–26). The latter figure is twice as high as that which can be calculated for *Latium* and *Campania*.

These basic facts strongly suggest that, although the fourth Augustan region was much larger than *Campania*, its aggregate urban population was much smaller. It also seems reasonable to interpret the wider spacing of towns in *Samnium* and *Sabinum* as pointing to a lower urbanization rate. In principle this makes it possible to model a large population. It would, for instance, be possible to assume an urbanization rate of 2–5%, in which case between 95% and 98% of the population could be assigned to the countryside. However, in view of the well-known Roman pattern of elite residence in towns and the existence of a positive link between levels of elite income and expenditure and levels of urbanization, it seems more plausible that *Samnium* and *Sabinum* not only had a vastly smaller number of town-dwellers than *Campania* but also a much smaller total population in town and country.¹⁴

The third and last regional network I want to discuss is that of *Picenum* (Figure 18.3). In recent years our understanding of the settlement system of this part of Italy has been much advanced by the Potenza Valley project of Frank Vermeulen and his Belgian and Italian collaborators (Vermeulen *et al.* 2003; 2005; Verreyke and Vermeulen 2009). If we combine the findings which have emerged from this project with those reached on the basis of topographical studies, it is possible to reconstruct a three-tier system made up of the following components:

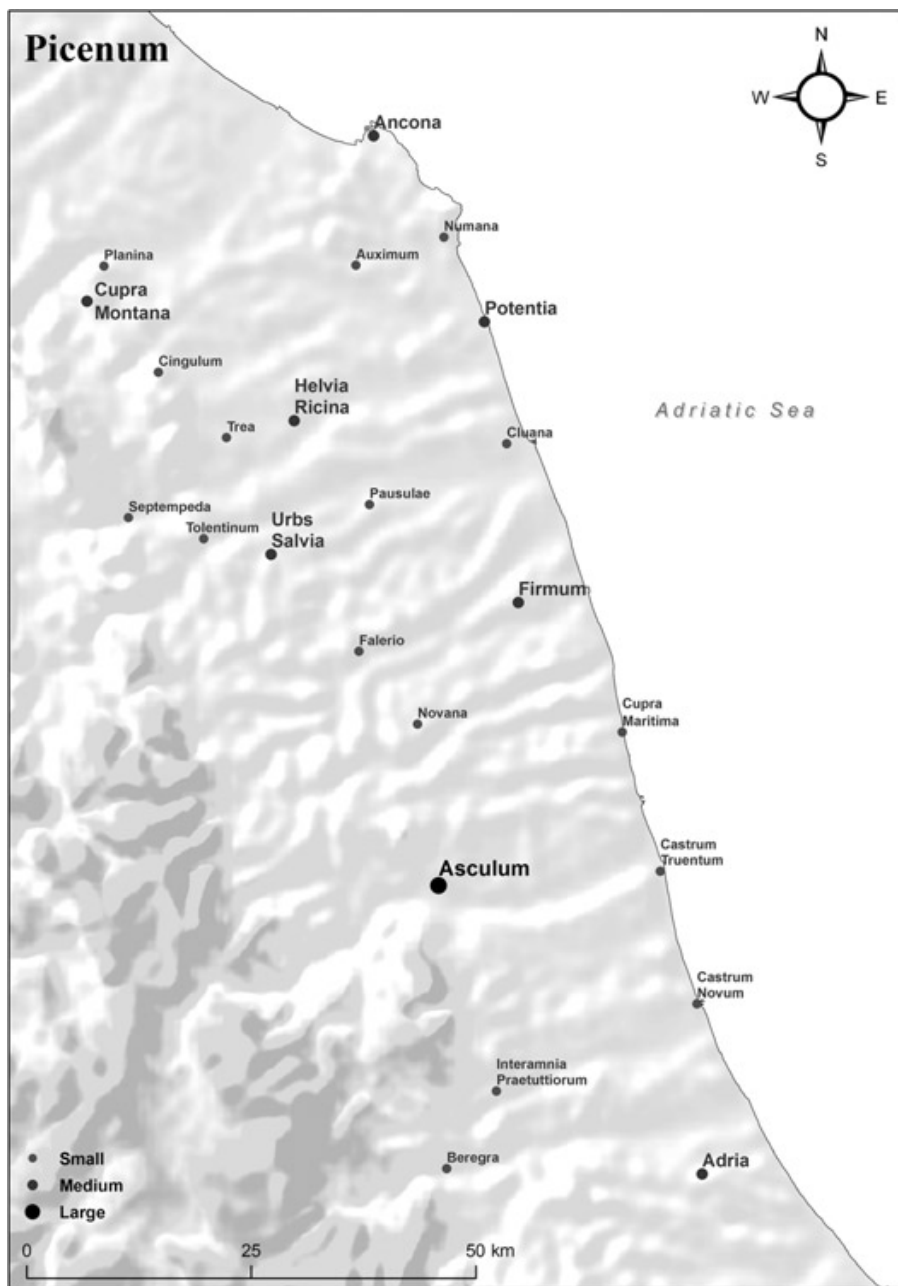


Figure 18.3 Self-governing towns in Picenum in the time of Augustus

2 large towns: *Asculum* and *Hatria* (?)

6 medium-sized towns: *Ancona*, *Cupra Montana*, *Firmum*, *Helvia Ricina*, *Potencia*, and *Urbs Salvia*

16 small towns: *Auximum*, *Beregra*, *Castrum Novum*, *Castrum Truentum*, *Cingulum*, *Cluana*, *Cupra Maritima*, *Falerio*, *Interamnia Praetuttiorum*, *Novana*, *Numana*, *Pausulae*, *Planina*, *Septempeda*, *Tolentinum*, and

With 23 self-governing towns in an area of 6500km² *Picenum* had a dense urban network. The average distance between towns in this area was 13.5km, which is only slightly higher than the corresponding figure for *Latium* and *Campania* (Bekker-Nielsen 1989: 25–26).

The main difference between the urban networks of *Picenum* and *Campania* is that the former region had far fewer large towns. Since the Campanian towns were both much larger on average and spaced more closely, there can be no doubt that *Picenum* had a much smaller urban population. What is more difficult to determine is whether it also had a much smaller total population. At least in some parts of *Campania* ‘villa’ sites account for a large proportion of rural sites (Arthur 1991). It seems a reasonable supposition that most of these ‘villas’ were slave-operated farms whose owners lived in towns. By contrast, the results of the Potenza Valley Survey suggest that small and medium-sized farms were a major component of the settlement system of the coastal districts of northern *Picenum* (Verreyke and Vermeulen 2009). If many of these farms were owned by peasants who lived in the countryside, this area would have had a large rural population.¹⁶ On this view, the small towns of *Picenum* would not only have been centres of elite residence but would also have served as focal points for a very substantial population of free farmers residing in the surrounding districts. The rarity of large towns in *Picenum* could then be explained as reflecting a lower urbanization rate rather than as pointing to an enormous discrepancy between the total populations of *Picenum* and *Campania*. The most plausible model is perhaps one which posits significantly smaller overall population densities in *Picenum* but narrows the gap with *Campania* by assuming a significantly lower urbanization rate.

Regional urban networks and the debate about Italian population numbers

In recent years one of the most interesting debates in ancient history has been the controversy between low counters and high counters. As is generally known, the origin of this debate goes back to the second half of the nineteenth century, but interest in the historical development of the population of Roman Italy was rekindled by a series of publications in which Elio Lo Cascio developed some new arguments in favour of the high count (Lo Cascio 1994; 1999a; 1999b; 2001).

In essence the debate hinges on the interpretation of the Augustan census figures. The most important figure is that for 28 BC, when roughly 4 million citizens were registered. If we follow the high counters in interpreting this figure as referring to adult male citizens, we end up with a free Italian population of roughly 13.5 million and with a total Italian population of

approximately 16 million.¹⁷ On the other hand, if the 4 million citizens of 28 BC are seen as including women and children of citizen status, we end up with a free Italian population of 4 million and with a total Italian population of about 6 million.¹⁸

What is sometimes overlooked is that both theories are based on the assumption that the Italian population was growing during the last two centuries of the Republic.¹⁹ There is, however, an important difference. According to the high count the Augustan census figures captured Italy's population more or less at its peak. There is a very simple reason why the high counters have to make this assumption. If population growth continued under the empire, we would quickly approach a level of 18 million (Table 18.1). Such a high level was not reached until the mid-nineteenth century, after Italy's agrarian economy had already been transformed in some important respects. In contrast to this, the low counters assume that the Italian population continued to expand during the first 180 years of the Principate. If their reconstruction is accepted, the population of mainland Italy peaked at about 8 or 8.5 million during the reign of Antoninus Pius (e.g. Beloch 1886: 437; Frier 2000: 812 and 814).

	225 BC	28 BC	AD 150
Low count	4.3 million	5.9 million	8 million
High count	6–8 million	16 million	16+ million

Table 18.1 The population of Roman Italy, 225 BC–AD 150.

In my view, a detailed investigation of the urban networks of Roman Italy may help us to shed some new light on this demographic debate. In what follows I shall try to make good this claim by first looking at Italy's towns from a static or synchronic point of view and then widening the scope of my paper to developments over time.

A synchronic approach: the towns of Roman North Italy in 28 BC

A synchronic approach means that we use the data brought to light by urban surveys and by topographical studies to estimate the area covered by a given town at one particular moment of Roman history. The logic of the high count/low count debate suggests that the size of a particular town at the time of the first Augustan census (28 BC) is of particular interest. In general terms the high count predicts towns which are much bigger than those posited by the low count. The reason for this is that both the low counters and the high counters are convinced that Roman Italy had a sophisticated economy in which between 15% and 20% of the Italian population outside Rome lived in towns. Since the Italian population predicted by the high count is about two and a half times bigger than that predicted by the low count, the high count logically implies the existence of an urban network containing a large number of substantial towns, and this is in fact exactly what the high counters have

argued (e.g. Lo Cascio 1999a; Kron 2005).

It must, however, be emphasized that neither the high count nor the low count can predict the size of individual towns. In most publications the participants in the debate are concerned with developments in Italy as a whole. It is also possible to construct a breakdown which distinguishes between population levels and urbanisation levels in northern Italy on the one hand and in central and southern Italy on the other. Unfortunately, however, it is not possible to construct a further regional breakdown, let alone a breakdown for individual towns.

The practical significance of these observations is that if we use a synchronic approach, urban survey archaeology can contribute to the demographic debate only if the results are combined with data pertaining to many other towns. The past couple of decades have witnessed an enormous increase in the number of archaeological publications dealing with individual towns, and there can be no doubt that this outpour has enormously refined our understanding of the urban history of many parts of Roman Italy. However, with so many publications focusing on individual towns there is also a danger that we will end up with a large number of local or regional stories in which the bigger picture disappears. In my view, if urban archaeology aspires to make a contribution to debates about regional and supra-regional developments, the only option is to bring together large amounts of local data with the aim of illuminating some of the quantitative properties of regional urban networks.

In a recent article I have tried to apply this approach to the towns of Cisalpine Gaul in the time of Augustus. To some extent the relative importance of the towns of Roman North Italy is illuminated by the literary sources, for instance by Strabo, who distinguishes between ‘noteworthy towns’ (*poleis axiologoi*) and ‘small towns’ (*polismata*) and singles out *Patavium* for its exceptional wealth and large population (Strabo 5.1.6–11). However, although these impressionistic clues shed some light on the relative importance of many northern towns, they do not allow us to put any figure on their physical extent.

Fortunately, this problem can be resolved with the help of the many topographical studies on the cities of Cisalpine Gaul that have been published during the past 50 years. Many of these studies give a precise figure for the extent of the inhabited area or contain maps from which an approximate figure can be derived. In other cases we are given information only on the number of hectares enclosed by the town walls. In these cases I have assumed that the entire walled area was inhabited. One reason for this is simply that the scattered evidence we have does not support the view that a large proportion of the areas enclosed by the town walls of the North was not built-up. My personal impression is that the towns of late republican and early imperial *Cisalpinia* were more compact than many of the cities of *Etruria*, *Latium* and *Magna Graecia* had been during the sixth, fifth and fourth centuries BC. It

seems significant that several towns in the North acquired suburbs in early imperial times. If there were large empty spaces within the town walls, one would expect most of these to have been built up before sizeable extramural quarters started to develop. In any case, in assessing the merits of the low and high counts for North Italy we should try to avoid minimizing the urban population by assuming – without good evidence – that a significant proportion of the areas enclosed by town walls did not have buildings.

In short, in assessing the area covered by the towns in Cisalpine Gaul, I used the following method:

1. In the case of unwallled towns I used existing estimates of the extent of those areas which were covered with buildings. Most towns of Cisalpine Gaul remained unwallled in the time of Augustus.
2. In the case of wallled towns it was assumed that the entire wallled area was covered with buildings at the time of the first Augustan census.²⁰ In so far as these towns had acquired extra-mural quarters in the time of Augustus, the areas covered by these quarters were added.
3. In those cases where the boundary line between republican quarters and imperial quarters was unclear, it was assumed that all early imperial quarters were already inhabited at the time of the first Augustan census.

It will be immediately apparent that my estimates for the areas covered by the towns of Cisalpine Gaul in the time of Augustus are biased in such a way that they are more likely to be too high than too low.

Although almost any attempt to gauge the built-up space of a specific Italian town in late republican or early imperial times must come with a considerable margin of error, some interesting conclusions can be drawn even at this micro-level. It can be demonstrated, for instance, that early imperial Milan covered about 80ha. It is instructive to compare this estimate with the far more precise figure which can be calculated for the same city in AD 1600. Around this year Milan covered approximately 800ha, ten times as much as in early imperial times.²¹

While this small observation is not without importance, it is more interesting to discover that a similar discrepancy existed on the level of the urban network of northern Italy as a whole. For early modern times the data collected by Jan de Vries and Paul Bairoch make it possible to reconstruct the urban system of this region with a fairly large degree of precision. It must, however, be emphasized that de Vries only considered towns which had population of 5000 or over, while Bairoch ignored all agglomerations with fewer than 3000 inhabitants (de Vries 1984; Bairoch 1988). Of course, these scholars are aware of the fact that large numbers of smaller settlements performed vitally important ‘urban’ functions for the rural population but, as they point out, the basic fact that there are no reliable lists of ‘towns’ having fewer than 5000 or 3000 inhabitants makes it necessary to use a relatively high threshold population in studies which aim to cover large areas or to

It will be immediately clear that many settlements in Roman Italy which had the legal status of towns must have fallen short even of Bairoch's 'low' threshold of 3000. Yet a comparison between the urban system of Roman *Cisalpinga* and that of North Italy in early modern times cannot be expected to produce any meaningful results unless we use the same definition of 'town' for both periods. I suggest that this methodological problem can be solved by limiting our analysis to those settlements which are likely to have covered 20ha or more. In other words, a meaningful comparison between the urban systems documented by de Vries and Bairoch and that which can be reconstructed for Roman Italy is possible only if we ignore the 'small towns' of Cisalpine Gaul, regardless not only of their juridical status but also of those 'urban' functions which many or most of them undoubtedly performed.²²

Table 18.2 The large and medium-sized towns of Cisalpine Gaul (c. 28 BC).

Taken together, these 46 towns can be shown to have covered about

1765ha.²⁴ The corresponding figure for the early modern towns is *at least* 7000ha.²⁵ In other words, in early modern times the towns of the north, collectively, were at least four times larger than their Roman counterparts. Yet the high count requires us to believe that, despite the modest size of the northern towns under Augustus, Cisalpine Gaul had a population of about 6 million, which is only marginally lower than the most recent estimate for AD 1600.²⁶

There are only two possible explanations: 1. either the high count is incorrect, or 2. urbanization rates in Roman *Cisalpinia* were much lower than those prevailing in early modern times. In practical terms we would have to assume that only about 5% of the northern population lived in towns having 3000 or more inhabitants under Augustus.²⁷ As we have seen, this outcome conflicts directly with one of the central assumptions of the high count, which sees early imperial Italy as highly developed and highly urbanized.

Urban contraction and expansion

The low and high counts not only imply completely different views of the size of the Italian population in the time of Augustus but also lead to widely diverging reconstructions of demographic developments during the last two centuries of the Republic and the first 150 or 180 years of the Principate.

According to the low count the last two centuries BC witnessed steady population growth in Italy as a whole, with the free and the unfree population rising from about 4.3 million to about 5.9 million in 28 BC (Table 18.1). It must, however, be realized that a very large proportion of this demographic increase was absorbed by the expansion of the Italian towns.²⁸ The growth of Rome is an obvious example. However, many further examples of urban expansion can be found in other parts of central and northern Italy, for instance in *Campania*, *Latium* and *Aemilia*. While the growing population of the city of Rome could be fed in part with provincial tax grain, most of the grain consumed in the large, medium-sized and small towns of Italy seems to have come from their own territories.²⁹ It therefore makes sense to suppose that the growth of the urban population was accompanied by demographic growth in the countryside.³⁰ Interestingly, most of the archaeological evidence from the countryside of central-western Italy can be interpreted as pointing either to demographic stability or to modest population growth during the last century of the Republic, while that for North Italy strongly suggests population growth.³¹

Even if we take into account the methodological difficulties surrounding the interpretation of rural survey data and other types of proxy evidence for demographic developments, it seems reasonable to conclude that, if we accept the low count as basically correct, the hypothetical increase of *c.* 1.6 million people predicted by this particular reconstruction of Italian population history would have to be assigned entirely to central and northern Italy. In other

words, the southern regions (from which I exclude *Campania*), taken together, must have experienced demographic stagnation or even some degree of population decline.

In my view, this is an area where urban survey archaeology can make an important contribution. Some interesting examples of what can be done are to be found in Gert-Jan Burgers' book on social, economic and demographic developments in southern *Apulia*. On the basis of ceramic evidence which was collected during a number of intensive urban surveys he concluded that the built-up area of the walled settlement of Muro Tenente shrank from about 28ha in Hellenistic times to less than 2ha in the early Empire (Burgers 1998: 66–68).³² Similarly, the inhabited area of the fortified settlement of Muro Maurizio contracted from about 14ha in Hellenistic times to a few hectares in the first century AD (Burgers 1998: 106–108). Some smaller fortified sites can be shown to have followed similar trajectories.

As Burgers points out, there are strong reasons for thinking that the harbour town of *Brundisium* went through a phase of significant expansion during the late Republic and early Empire. He is therefore inclined to interpret the archaeological evidence as pointing to a realignment of the settlement system rather than as suggesting demographic decline. It must, however, be remembered that the size of the built-up area of early imperial *Brundisium* did not exceed 65ha.³³ With so many of the older fortified settlements declining and in the absence of strong population growth in the countryside – except, significantly, in the *Ager Brundisinus* – it remains difficult to avoid the conclusion that the population of southern *Apulia* declined in late republican and early imperial times.

Some towns in other parts of southern Italy also seem to have declined during the last centuries of the Republic. Of the 141 ha enclosed by the town wall of *Herakleia* only 10 ha continued to be inhabited during the early Empire and in *Metapontum* few signs of habitation have been detected outside of the area of the so-called *castrum*, which covered only 14 ha; similarly, in the interior districts of *Lucania* the towns of *Bantia* and *Civita di Tricarico* are thought to have experienced a drastic decline.³⁴ In all these cases there are no indications that the decline of the urban population was compensated for by a simultaneous process of demographic expansion in the countryside.

Of course it would be dangerous to build any far-reaching conclusions on this handful of examples. They do, however, support the traditional low-count view that the last two hundred years of the Republic saw significant demographic growth in northern and central-western Italy and at least some measure of demographic decline in various parts of *Apulia*, *Magna Graecia* and *Lucania*.³⁵

I would like to end this contribution by adding a few observations on developments during the early Empire. While the contrasting fate of some of the towns of northern and southern Italy during the Republic has attracted a considerable amount of attention, very little has been written about the history

of the Italian towns during the first two centuries of the Empire, Rome being the main exception to this rule. Yet there can be no doubt that the urban history of early imperial Italy is a topic of central importance for those interested in the demographic history of Italy. The reason for this is that the low and high counts imply two strikingly different reconstructions of the fate of the Italian population between the start of the Principate and the arrival of the Antonine Plague. As we have seen (Table 18.1), a central tenet of the low count is that between c. 30 BC and AD 150 the Italian population expanded from roughly 6 million to approximately 8 million. By contrast, if the high count is correct, population levels in early Augustan Italy must have matched those reached at the end of the eighteenth century, so that there was little scope for further growth during the next 180 years.

In a forthcoming monograph I attempt to shed some new light on this issue by examining the vast amount of data which have been brought to light by the rural survey campaigns of the past 60 years. However, we should also ask whether there is any evidence for urban expansion in Italy between the beginning of the Principate and the third quarter of the second century AD. Since the literary and epigraphic sources are of little help when it comes to answering this question, this is another field where the local or regional trends revealed by urban surveys and topographical studies are of crucial importance.

In his recent book on early imperial Italy John Patterson discusses a handful of interesting examples (Patterson 2006: chapter 2). One of these is the town of *Interamna Lirenas* in southern *Latium*. As the investigations carried out by Hayes and Wightman have revealed, *Interamna Lirenas* reached approximately 30ha in the first century BC. However, from the first century AD onwards the town shrank to about a third of its former size (Hayes and Wightman 1984). Part of the explanation seems to be that the *Via Latina* had been diverted away from the town, while *Interamna* may also have lost a significant part of its territory to the neighbouring towns of *Aquinum* and *Casinum*. Since these two towns seem to have flourished in early imperial times, one is left with the impression that this is a case in which the decline of one town was compensated for by the growth of other centres.

Patterson also discusses the archaeological evidence from *Beneventum* (Patterson 2006: 106–115). Since most of the Roman town is covered with modern buildings, he uses archaeological and epigraphic evidence for building activity as proxy evidence for urban expansion. As he admits, a detailed reconstruction of the history of *Beneventum* cannot be achieved. Despite this, it can be convincingly demonstrated that *Beneventum* prospered during the early Empire and that this was a period of significant population growth.

In other parts of peninsular Italy we encounter further examples of urban expansion in early imperial times. One obvious example is early imperial Ostia. Another is *Amiternum*. Judging from the investigations which have

been carried out during the past couple of years, this town expanded from a modest beginning in republican times to about 60 or 70ha in the course of the first century AD (Heinzelmann and Jordan 2007).

Closer to Rome, *Tibur* is also thought to have grown in size and population in early imperial times, and clear signs of urban expansion have also been detected in the port towns of *Antium* and *Terracina*.³⁶

If we broaden the scope of our inquiries to North Italy, we come across numerous further examples of urban growth after the end of the Republic. One thinks not only of the continuing expansion of large towns such as Milan, *Altinum* and *Aquileia*, but also of the growth of various medium-sized and small towns, such as *Eporedia*, *Tarvisium*, *Tergeste* and *Vada Sabatia*.³⁷

It seems possible to conclude that the early Empire witnessed the expansion of urban populations in various parts of central and northern Italy. As we have seen, this development matches the predictions of the low count, which sees the first 180 years of the Principate as a period of substantial population growth.

I would like to end this contribution on an optimistic note. During the twentieth century many attempts have been made to estimate the population of individual towns on the basis of archaeological evidence. As is generally known, exercises of this kind are widely regarded as problematic. However, even if we accept that the evidence from *Pompeii* and other towns is compatible with a variety of population estimates, investigations into processes of urban contraction and expansion and into the quantitative properties of regional urban networks remain highly relevant to the demographic debate. For this reason alone there is every reason for archaeologists to intensify their efforts to elucidate the history of the towns of Roman Italy through excavation, topographical studies and urban surveys.

Notes

- 1 Bintliff 1997. In most parts of early-modern Europe urbanization rates did not exceed 20% (see de Vries 1984).
- 2 This traditional picture was challenged by Alcock (1993), but see my remarks in De Ligt 2004. According to Alcock, the Roman period witnessed the expansion of Phlius and Corinth, but the ceramic material from Phlius remains unpublished and her assessment of Roman Corinth is now thought to be too positive (John Bintliff, pers. comm.)
- 3 For a discussion of some of these problems see De Ligt 2008.
- 4 My third category does not include any *vici*, although some of these non-urban settlements can be shown to have been larger than some small 'towns'. Of course, the existence of large *vici* shows that a strictly juridical approach (or an approach which looks at juridical status and size) cannot be expected to result in a more or less complete reconstruction of the lower tiers of regional settlement systems. On the other hand, not a single *vicus* in the three areas which will be investigated is known to have covered 20 or more hectares in the time of Augustus. In the course of the first and second centuries AD some *vici* in northern Italy can be shown to have expanded beyond this threshold, so that at least in this area the picture becomes more complicated.
- 5 As always, it is possible to find exceptions. A well-known instance is the Apulian town of

- Rudiae* which seems to have been very small (Duncan Jones 1982: 271) but nevertheless had a large amphitheatre. The large seating capacities of some of the theatres and amphitheatres which have been found in the medium-sized and small towns of *Samnium* suggest that many spectators came from the surrounding districts. One possible explanation for this is a low urbanization rate.
- 6 The seminal work was Beloch 1890. While later research has confirmed some of his estimates for the size of Campanian towns, most of them can no longer be regarded as reliable.
 - 7 For detailed references I refer to De Ligt 2011. Since *Casilinum*, *Stabiae* and *Saticula* were no longer self-governing towns in the early Empire, I have not included them in my list. Judging from Pliny the Elder (*NH* 14.62), *Urbana* was still a separate town under Augustus. Later it was attributed to *Capua*.
 - 8 *Cales*, *Cumae*, *Neapolis*, *Nola*, *Nuceria*, *Pompeii*, *Puteoli* and *Teanum*.
 - 9 Bekker-Nielsen (1989: 25–26) gives a single figure for the first Augustan region, which also included *Latium*, but a look on the map shows that towns were closely spaced throughout *Latium* and *Campania*.
 - 10 Jongman (1988: 122) reckons with a Campanian urbanization rate of *c.* 33%. Note that the relatively high urbanization rate which was achieved in Roman Egypt has also been explained as reflecting the exceptional fertility of the Egyptian soil (see Bagnall 2009: 111).
 - 11 Below, at note 37. In the Augustan period the town wall of *Marruvium* enclosed *c.* 40ha but only two-thirds of this area seem to have been covered with buildings.
 - 12 Detailed references in De Ligt 2011. I have assumed that *Anxa*, *Angitia* and *Lucus Angitiae* were one and the same town, that there was a single town of *Bovianum*, and that *Ficolea* and *Fidenae*, which are listed by Pliny as towns of the fourth Augustan region, are identical with the homonymous towns in *Latium*. The whereabouts of *Caretia Supernas* and of *Caretia Infernas* are unknown and in fact we cannot be certain that the Caretini Supernates and Infernates were administered from towns bearing these names. *Nursia* and *Peltuinum* have been included among the medium-sized towns because their town walls enclosed 22.5ha and 22ha respectively, but it seems probable that these areas were not entirely covered with buildings. My figure for the medium-sized towns may be too high, that for the small towns too low.
 - 13 Detailed figures in De Ligt 2011.
 - 14 According to Patterson (1991: 152–154) many wealthy Samnites opted for urban residence in late republican and early imperial times. For levels of elite expenditure as a major determinant of town size see Jongman (1988: 192–196). As noted by Duncan Jones (1982: 339), the average number of inscriptions per 100km² is 55 for the first Augustan region (without Rome and *Pompeii*) against 16.1 for *regio IV*.
 - 15 Detailed references in De Ligt 2011. Conventi (2004: 43) gives *Hatria* only 22ha, but if we accept the alternative reconstruction offered by Guidobaldi (1995: 198–199), the town wall enclosed an area of *c.* 70ha. Guidobaldi thinks it likely that only part of this area was built up.
 - 16 cf. Hopkins (1978: 106–107) for the suggestion that slave-operated estates had lower labour/land ratios than peasant farms.
 - 17 If adult males made up 30% of the population and if the census of 28 BC captured 90% of the target population (a high figure), 4 million adult male citizens imply a total citizen population of *c.* 14.75 million. Of these *c.* 1.25 million can be assigned to the provinces. A valuable overview of the debate is Scheidel 2008.
 - 18 The low count assumes that the census of 28 BC captured 80% of the target population and that about 1 million citizens lived in the provinces.
 - 19 Lo Cascio (1994) argues that the low count implies an enormous decline in the number of free country-dwellers during the last two centuries of the Republic, but as he admits, this conclusion follows only if we set aside Brunt's suggestion that the census of 28 BC failed

- to capture more than 80% of the target population. Hopkins (1978: 69–70) assumes a considerable decline in the number of free country-dwellers but also that this decline was fully compensated for by the expansion of rural slavery. More recent versions of the low count (e.g. De Ligt 2004) assume that there were fewer rural slaves but also that the free rural population of Italy as a whole did not decline significantly before the large-scale emigrations of the mid-first century BC. For a full discussion of these problems I refer to De Ligt 2011.
- 20 Note that this tactic works better for some parts of early-imperial Italy than for others. It would, for instance, be hazardous to assume that all of the 120ha enclosed by the town wall of the Lucanian town of *Paestum* were covered with buildings in early-imperial times. As a general rule the walled towns of *Etruria* and *Magna Graecia* are more problematic than those of northern Italy.
 - 21 On the area covered by *Mediolanum* in the early years of Augustus see e.g. Ceresa Mori (1995: 471). On the size of the same city in the mid-sixteenth century (794ha) see e.g. Beloch (1937–1961, III: 156).
 - 22 Note that the logic of my argument makes it impossible to argue that at least some ‘small towns’ must be included in the comparative analysis because they had a forum, shops, a basilica, or a theatre and therefore must have performed ‘urban’ functions for the population of the surrounding districts. Of course urban settlements covering fewer than 20ha would have to be included if we had sufficient information to allow a reliable reconstruction of the lower tiers of the urban network of early modern Italy, but as we have seen this kind of information is not available at present.
 - 23 Although *Atria* and *Ateste* seem to have been substantial towns in the time of Augustus, the size of their built-up areas cannot be determined. My hypothetical figure of 28 ha for these towns corresponds to the average size of those medium-sized towns for which estimates have been offered on the basis of the archaeological evidence.
 - 24 As noted in the main text, this figure refers to the total area covered with buildings, including suburbs.
 - 25 At the beginning of the seventeenth century the largest eight towns of North Italy covered c. 3430 ha. There were 54 further towns with 3000 or more inhabitants (cf. De Ligt 2008).
 - 26 The high count assigns c. 40% of the population of Roman Italy to Cisalpine Gaul (e.g. Kron 2005). A total Italian population of c. 16 million therefore implies a northern population of c. 6.4 million. In AD 1600 North Italy is thought to have had c. 6.5 million inhabitants (see Del Panta *et al.* 1996: 277).
 - 27 In early modern times c. 20% of the population of North Italy lived in towns with more than 5000 inhabitants. Since the total area covered by the towns of Roman North Italy was four times smaller, the Roman urbanization rate cannot have been much higher than 5% if North Italy had more than 6 million inhabitants in 28 BC. In principle this conclusion could be avoided by assuming that the towns of Roman North Italy were more densely populated than the North-Italian towns of the late sixteenth and early seventeenth centuries, but I do not think there is any concrete evidence to back up this theory. In fact, judging from the archaeological literature, the domestic architecture of early imperial *Cisalpinia* is characterized by an extensive use of space. For more detailed discussion see De Ligt 2008.
 - 28 According to Hopkins (1978: 68) the ‘urban’ population of mainland Italy rose from c. 650,000 in 225 BC to c. 1.9 million in 28 BC. Although his estimates refer to the number of people having ‘urban’ (i.e. non-agricultural) jobs rather than to the number of urban residents, they give us a rough idea of the fast pace of urban expansion during the final centuries of the Republic.
 - 29 Even the population of Rome could not be fed entirely with imported tax grain.
 - 30 Of course the adoption or spread of more efficient systems of agricultural production could also be part of the answer (cf. note 17).
 - 31 E.g. Witcher (2008); Quilici and Quilici Gigli (2009). Launaro (2008) also detects signs of

- population growth in the countryside. However, since he operates with a binary distinction between Republic (200 BC–50 BC) and early Empire (50 BC–AD 100), it remains unclear how much of this growth can be attributed to republican times. Note that his starting date for the early Empire (represented by early imperial sigillata) is too early.
- 32 From around the mid-second century BC the locally produced Apulian black gloss ceramics were displaced by grey gloss pottery, which seems to have been made in a handful of production centres (*ibid.* 269). However, while the relative dearth of imported pottery helps to explain the thinness of the late-republican pottery scatters, it does not explain their small size. In any case, the disappearance of almost all local centres for the production of finewares can be plausibly explained as pointing to population decline.
- 33 According to Lippolis and Lippolis Baldini (1997: 310), Roman *Brundisium* covered no more than 56ha; *Aprosio* (2008: 90 n.28) assigns it 62ha.
- 34 *Herakleia*: De Siena and Giardino (2001: 163); *Metapontum*: Carter (2006: 240); *Bantia*: Marchi (2009: 356); *Civita di Tricarico*: Giardino (2005: 778).
- 35 I hasten to add that I do not accept Toynbee's theory that the Hannibalic War set in motion a process of widespread and unstoppable decline in southern Italy. It seems better to think in terms of long-term developments which were connected with the political, military and economic integration of southern Apulia and other parts of southern Italy into a system which became increasingly focused on central-western Italy. For signs of population growth in the *ager Brundisimus* during the late Republic see *Aprosio* (2008: 121).
- 36 *Tibur*: Giuliani (1970: 48); *Antium*: Brandizzi Vittucci (2000); *Terracina*: Lugli (1926).
- 37 De Ligt 2008. Full references.

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GIS and Intervisibility Analyses for the Study of Archaeological Landscapes – Problems of Interpretation. Case Study: The Murge Plateau in the Archaic Period

G. Semeraro

Introduction

This paper makes reference to various research projects conducted over the last few years in the northern Salento by the Università del Salento. These include the use of GIS as a tool for the study of landscapes, with particular reference to spatial analyses that better illustrate the relationships between human beings and the territory. In technological terms, this line of research was initiated at the *Laboratorio di Informatica per l'Archeologia* (Archaeological Computing Laboratory) of the University of the Salento as part of a series of research activities¹ focusing on patterns of settlement in the pre-Roman Salento (D'Andria and Semeraro 2003; Semeraro 2002). Thanks to the resources made available by the LandLab project² (which began in 2003) it was possible to implement an on-line information system, the Settlement Web GIS, currently viewable via the Internet (D'Andria and Semeraro 2006; Semeraro 2008). The relevant cartography (DEMs, geological maps etc.) was created as part of the LandLab project, together with the database of archaeological evidence. It contains the results of the research conducted in the Messapian Salento, and provides a useful reference point for the development of further research. The project described here as a case study, the 'Murge Settlements' Web-GIS, belongs to the second phase of this research, which was launched in 2006 at the end of the LandLab project. It focuses on the analysis of a geographical area that has not yet been thoroughly investigated from the archaeological point of view, corresponding to the broad range of hills between Taranto and Brindisi.

The project represents one of the lines of research by which the University of the Salento is contributing to the broader, interdisciplinary 'Murge Tableland Project', which benefits from the participation of the Universities of Amsterdam, Rome ('La Sapienza') and Foggia. This project aims to reconstruct the different forms of interaction between people and the environment and the transformation of social structures in the territory on

large time scales, from prehistoric communities to the Messapians, Greeks (Taranto), and up to modern times.

State of the art

Generally speaking, the application of GIS technology to Mediterranean archaeology³ is still fairly limited, and appears to be used mainly for individual registration and precise positioning of data. On the other hand, little use is currently being made of tools such as spatial analyses, which are useful for introducing cognitive approaches to the study of the landscape, in line with the methodological orientation developed in the context of post-processual archaeology (Renfrew and Zubrow 1994; Lock and Stančič 1995; Ashmore and Knapp 1999). We refer particularly here to the ‘non-material’ and symbolic aspects of the human-environment relationship, recognising that the dynamics of the visual ‘perception’ of the territory play an important role in the modeling the social history of human communities. In this context, visibility analyses play a key role (see methodology below).⁴

The case study presented here looks at the northern part of the Salento. From the point of view of the archaeological research, this area is somewhat varied. The flat area between Brindisi and Taranto – the isthmus – has been subject to systematic research since the 1980s (D’Andria 1991; Yntema 1993; Burgers 1998), centred on individual settlements and specific stretches of territory. This is not the case, however, for the state of the research in the hilly area corresponding to the plateau of the Murge. During the pre-Roman epoch there are known to have been large settlements such as those of Ceglie Messapica and Ostuni. What is lacking is a precise picture of the structure of the settlements, comparable to what is available for the southern part of the Salento peninsula.

The systematic study of the territory began with the survey programme conducted as part of the Dutch ‘Regional Pathways to Complexity’ project (Burgers, Attema and van Leusen 1998; van Leusen 2002) and the reconnaissance carried out for the creation of the Archaeological Map of the territory of Cisternino (BR) (Burgers and Recchia 2009). However, large parts of the Murge plateau between the Ionian and Adriatic seas have so far only been studied by local amateurs, who have reported a number of phenomena over the years. One of the limits of this type of data is that it yields few elements that would help to determine the size of the settlements and the chronology of the sites. The distribution maps drawn at the conclusion of the LandLab project (2005), like the map of the settlements dated to the Archaic age (Figure 19.1), reflect these aspects of the research. The maps show only those pre-Roman sites which could be dated with certainty. There is a very obvious ‘empty’ patch northwest of San Vito dei Normani, reflecting the lack of accurate data on the chronology and type of settlements. The state of the research in the Murge area stands in sharp contrast to the far more developed

situation in the isthmus area of the Salento and the southern part, where settlement systems characterized by sites with various levels of complexity are now clearly evident (D'Andria 1991; 2002).

Various recently launched projects provide important reference points for the reconstruction of settlement dynamics in the Murge plateau during the Iron Age and Archaic period. These include the study of the 'Castello di Alceste' site (San Vito dei Normanni), the Archaic settlement located on the eastern side of the town, in an area of transition between the hilly area and the plain of Brindisi⁵; the research begun in 2006 in another Murge site called Castelluccio (Cisternino – BR) (Semeraro 2009b); and the extensive surveys in the area of L'Amastuola (Burgers and Crieelard 2007), located on the western edge of the Murge. These research projects are enriching our knowledge of a crucial period in southern Italy, which was also marked by Greek 'colonization'. Indeed, they highlight the chronologically parallel phenomenon of the birth of new settlements, which need to be defined and studied by means of systematic analysis.

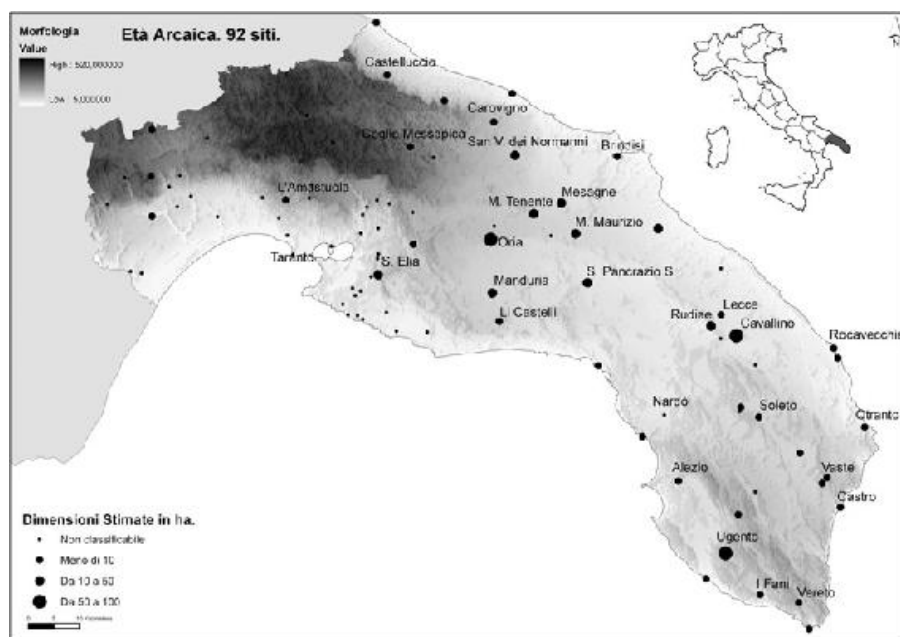


Figure 19.1 Salento. Archaic period. Map of settlements (2005).

Methods

This study makes reference to a series of analyses with two objectives:

- to draw up predictive hypotheses concerning the most appropriate research strategies;
- to begin the analysis of settlement patterns on the level of the macro-area.

The 'Murge Settlements' GIS project sought first of all to analyse the state of the research. To gather the information, the structure already designed for the Salento Settlements Web GIS project (Semeraro 2002; 2008) was used. This structure was composed of records providing a formal description of the evidence available. The data acquired so far partly derive from the systematic reconnaissance carried out during the Murge Tableland Project (Burgers and Recchia 2009) for the creation of the archaeological map of Cisternino. They are also partly made up of one-off reports. The new 'Murge Settlements' project has enabled us to gather evidence relating to a further 75 sites with respect to the data already recorded in the Salento Settlements Web GIS project (Figure 19.2).

By exploring the set of data available, incomplete and heterogeneous as this may be, we sought to identify appropriate ways to get the most from the information and suitable strategies for conducting research into the area.

The data were therefore examined with a view to drawing up a provisional classification in terms of the type and chronology of the evidence.

Some reports refer to complex and multi-layered sites, with trace dating back to the proto-historic period and evidence from as late as the Middle Ages, often in settlements characterised by long continuity of life, such as Masseria Badessa Vecchia or Locorotondo, where the stratigraphic research is limited to a few surveys carried out in the 1990s (Maruggi 1989a; 1989b; 1991; Ciancio 1990).

We classified these data as macro-evidence corresponding to complex sites (type A data). At the present time it is not possible to establish the dimensions of the settlements in their various phases of occupation. It seems clear, however, that these sites were fairly large, especially in the Hellenistic phase, when they played an important role in the settlement system, on the level of better studied settlements such as Oria or – again in the area of the Murge – Ceglie Messapica.

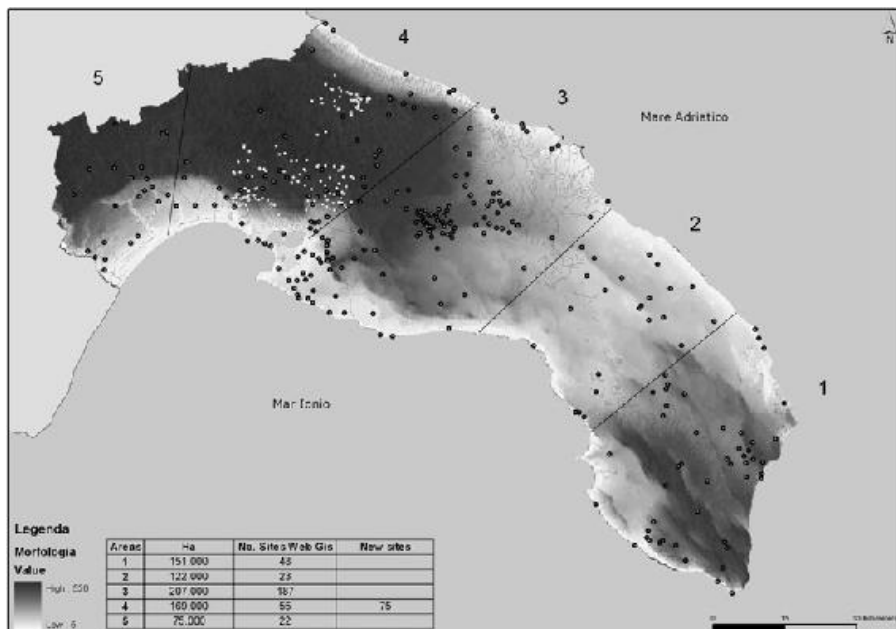


Figure 19.2 Salento. New sites (in white) catalogued in the 'Murge Settlements Project' database.

In other cases the reports refer to areas of clay fragments, occasionally discovered in fields, or to the discovery of isolated tombs or coins. Also fairly frequent are reports of strata discovered in caves: the presence of figurative terracottas, discovered many times, suggests that these cavities had a religious function. These reports need to be verified (type B data).

A third type of data is place names referring to the presence of *specchie*,⁶ or to places with some form of lookout function, such as La Guardiola and Guardarello (from the Italian *guardare*, to look).

Starting from this sparse and fragmentary basis we have begun a series of spatial analyses designed to explore the data and determine how best to study them. The distribution of the sites and reports was compared with the hydrological and soil potential maps drawn for the LandLab project in order to study their relationship with the natural resources. We then sought to identify the most suitable analyses for studying the interaction between human activities and the complex but distinctive orography of the Murge, characterized by gentle undulations and low ridges. The spatial analyses used were mainly of three types: *cost surface*, *network*, *viewsheds*.⁷ The results of the analyses are strongly dependent on the accuracy of the digital terrain model (DTM or DEM).

Cost surface analyses enable the calculation of journey times by cross-referencing data on the length of the journey with data on the morphology of the landscape. Network analyses were used to identify the easiest routes across rugged terrain. Both types of analysis have proved to be very useful for

reconstructing the relationship with the territory, which is quite different from what has been observed in the flatter areas of the Salento peninsula.

Finally, viewshed analyses, or inter-visibility analyses, were used to explore the visual relationship with the territory, bearing in mind the symbolic aspects of the relationship between humans and the landscape. It is particularly important in this sense to reflect on the dynamics of visual communication in pre-industrial societies. This theme is tackled in accordance with an interpretative approach that takes account of the relationship between perception of the landscape, systems of communication and ways of organising the settlement system.

Results

It is not easy to set out the results concisely, because most of the observations made on the basis of the data serve to formulate hypotheses which then need to be validated via research on the ground. However we do feel it is important to highlight certain aspects that emerged with particular clarity, which help to identify distinctive features of the occupation of the Murge.

One element that stood out in the preliminary phase of the study is the relative density of archaeological evidence, which is particularly striking when one considers the mainly random nature of the reports (Figure 19.2). The number of finds is destined to increase as the systematic surveys get under way, but it can already be asserted that the hilly areas of the Murge plateau were subject to fairly dense occupation. Although the chronology of the features still needs to be precisely determined, it seems clear that the occupation dates back to the proto-historic period. In most cases the reports correspond to areas that were occupied until recent times by the traditional farmhouses known as ‘masserie’, which in the Murge are usually located on the hilltops.

The cost surface analyses suggest that the landscape was relatively difficult to travel across. Illustrative of this aspect is the observation by Strabo, who estimated the distance from Brindisi to Taranto (c. 60km) at one day’s walk for a good walker (Strabo, vi 3, 5). Covering the same distance in the Murge takes considerably longer. As can be seen in Figure 19.3 the portions of territory on the plateau that can be crossed in two hours are significantly smaller. Even the average distances between complex sites are lower than what is seen in the plains of the Salento.

Transport routes have remained unchanged for long periods. This is fairly common in mountainous terrain, where the passing points are conditioned by the morphology of the land. In hilly areas the situation can be different because the natural obstacles are never insurmountable, merely harder to get round. While studying this aspect it was very interesting to compare the results of the network analyses with the layout of the rural road network as used in modern times. In most cases, the routes designated by the system on

the DTM coincide with the country lanes and sheep trails, which were still in use until about 50 years ago (Figure 19.4). This indicates a landscape conserved intact right up until modern times.

Visibility analyses allow us to make a series of interesting observations. Starting with those sites that are known to have hosted complex settlements, we performed a series of visibility analyses in order to observe and describe the visual perception of the area. On the heights of the Murge, the fields of visibility of the complex settlements (type A) give the impression of a territory that was 'difficult' to see, as is shown by the numerous shadow zones highlighted by the viewshed analysis (Figs 19.5 and 19.6). Given the absence of mountains there are few points providing a commanding view of the territory. Even the visibility radius from the highest point in the province of Terra d'Otranto (500m above sea level) is limited, because the numerous other heights nearby constitute natural obstacles.

The theme of visual communication also appears to be relevant to the reconstruction of those elements that formed the connective fabric of the communities, above all the sacred, religious and ceremonial dimension. Indeed, the visibility analyses make it possible to highlight the role of sacred sites in the definition of the landscape. Of particular interest in this regard is the location of sites in which there appear to be traces of religious activity, such as the series of sacred caves located on the ridges of the plateau (Figure 19.7). These are located at the intersection of lines of sight, in positions that are highly favourable to the visual surveillance of the territory (Figure 19.8). The distance from the complex settlements (type A sites) appears to be compensated by the existence of a relationship of visual communication. The religious caves are sited in 'strategic' points of the territory in the sense that they enjoy views over (and can be seen from) a considerable distance. This aspect constitutes an important element in the complex relationship between community and landscape. The visibility analyses enable us to visualise the pattern of distribution of sacred sites in the territory, which seems to be specific to the plateau, highlighting the 'physical' role of visual connectivity in the construction of the sacred landscape of the Murge.

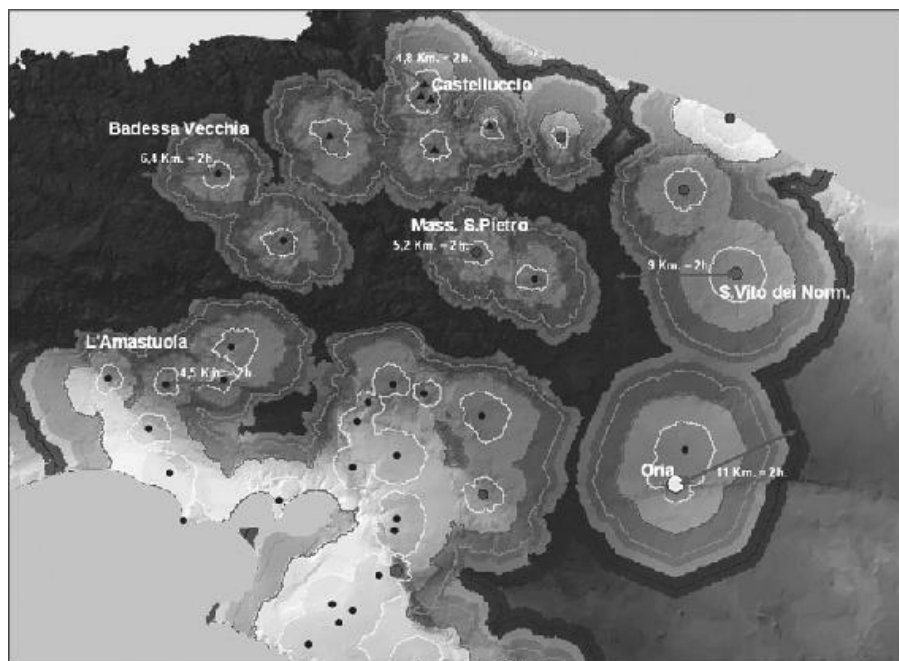


Figure 19.3 Salento, Murge area: cost surface analysis.

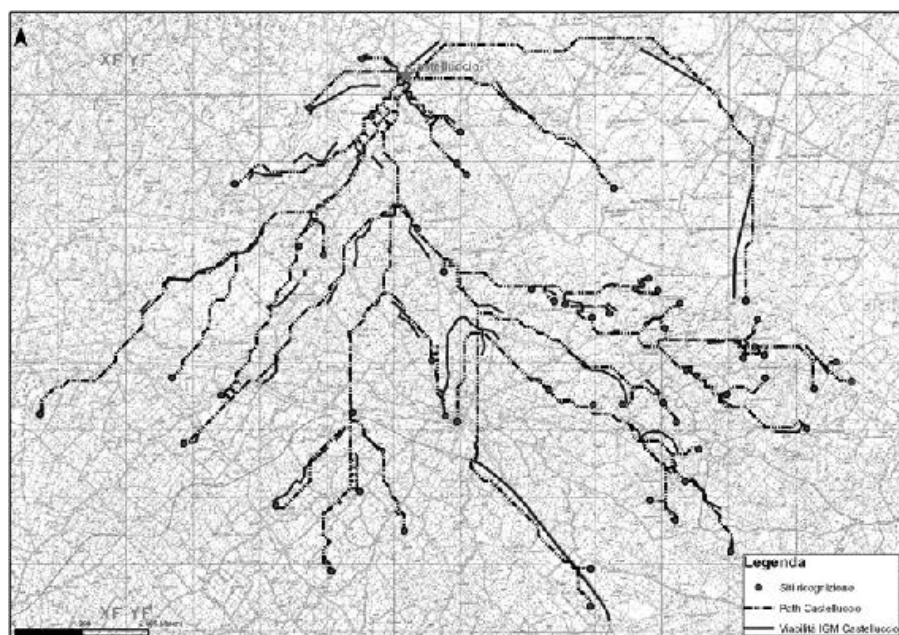


Figure 19.4 Network analysis in the area around the Iron Age site of Castelluccio (Cisternino – BR) showing the least-cost paths (broken lines), superimposed to the level of rural roads (unbroken lines).

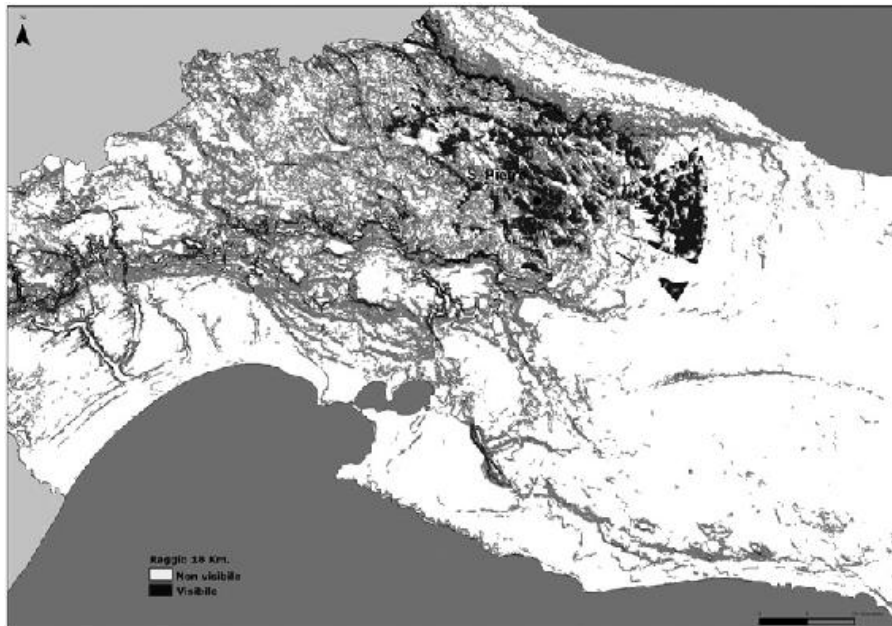


Figure 19.5 Example of viewshed analysis in the Murge area (site of Monte S. Pietro, near Ceglie Messapica – BR).

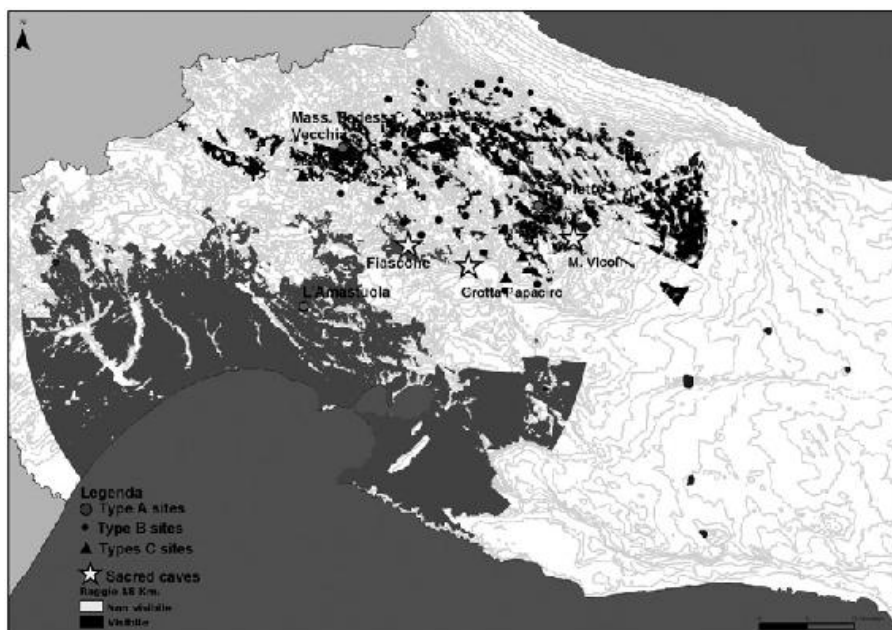


Figure 19.6 Cumulative viewshed analyses.

Conclusions

From the methodological point of view, one aspect that has frequently been

noted by researchers is the efficiency of the intervisibility analyses as a predictive tool in the identification of sites of archaeological interest. The initial results in the study of the Murge indicate that in terms of identifying sites the approach adopted is valid and fruitful.

Concerning the features of the landscape of the Murge plateau, an important point to note is the considerable number of sites of small dimensions. They seem to be particularly characteristic of the proto-historic and Archaic periods, and their density constitutes a distinctive feature of the human occupation of this area. In the few cases that have been subject to stratigraphic research, that is the sites of Castelluccio, San Vito dei Normanni and L'Amastuola, the eighth century BC emerges as a decisive moment for the consolidation of a new system of settlement that was to last at least until the Archaic period. It reflects a process of identity formation that needs to be investigated more fully in terms of its territorial aspects.

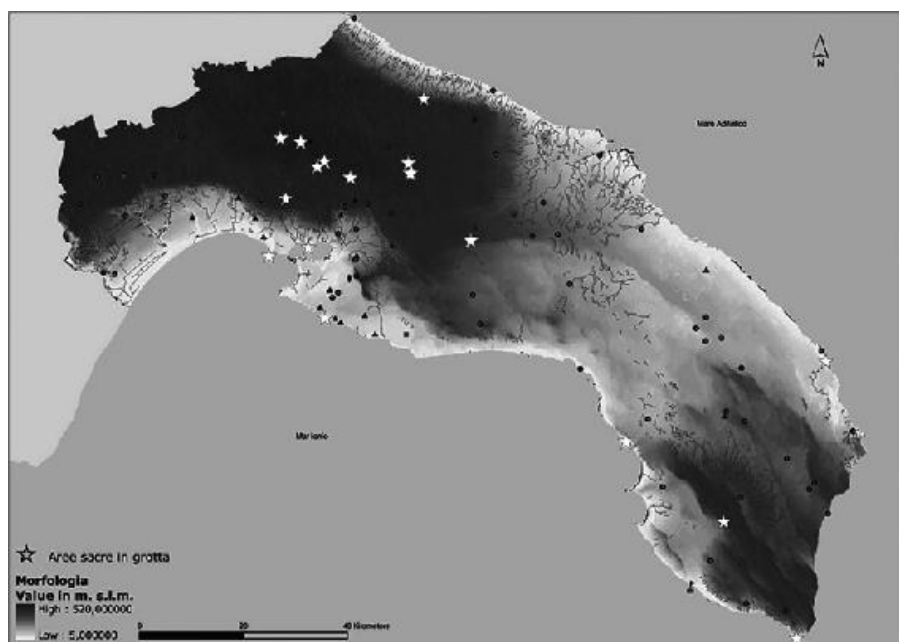


Figure 19.7 Salento. Distribution of sacred caves.

The research begun in the Murge is of considerable interest in this respect, especially if one considers its geographical location, in the centre of the routes linking the Adriatic to the Ionian sea coasts, which were subject to Greek colonization.

Although the research is still in the early stages, the findings are consistent with the presence of complex settlements (which had previously not been recognised as such), which in turn suggests that the settlement system was more elaborate than first thought. From this point of view, the research that has just started in the site of Badessa Vecchia promises to be very interesting.

Largely unexplored until now, this site is characterised by a continuity of settlement from the Iron Age until the Middle Ages.

One element on which to focus attention is the role of the sacred caves, as emerges from the visibility analyses. The reports of finds are currently helping us to draw the lineaments of a sacred landscape that has no immediate parallel with the rest of the Salento, where the phenomenon of religious sites outside urban areas seems to be confined mainly to landing places on the coast.⁸ In the plateau of the Murge the wealth of evidence for religious activities found in caves reflects the specific characteristics of a region that is heavily influenced by karst phenomena. Although the specific aspects of the cults need to be verified case by case,⁹ together with the chronology of occupation, it is clear that in the pre-Roman period the sacred caves located at some distance from the settlements played an important role as geographical landmarks and as places where communities could come together.

In this historic landscape, most of which is yet to be explored, the theme of religious sites that were scattered over the territory but occupied strategic positions in terms of visual communication, constitutes one of the most promising lines of research in reconstructing the specific cultural identity of the communities that inhabited the plateau.

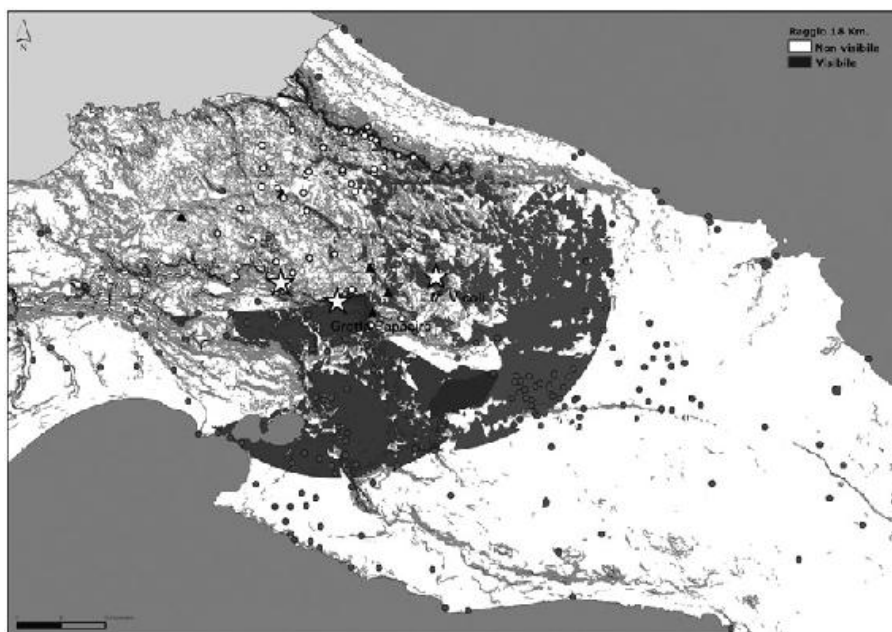


Figure 19.8 Sacred caves (stars) in Murge area. Viewshed analyses.

Notes

- 1 For the Laboratory's activities and related bibliography see: <http://lia.unisalento.it>
- 2 'Progetto LandLab' (LandLab Project – Multimedia Laboratory for Research, Education and Communication regarding Archaeological Landscapes); <http://landlab.unisalento.it>

- 3 For an overview of the research in this sector see the periodical *Archeologia e Calcolatori*.
- 4 On the archaeology of southern Italy see Van Leusen 2002; Pecere 2006; Semeraro 2009a.
- 5 Systematic surveys of the site, which began in 1995, have been conducted jointly by the University of the Salento, the municipality of San Vito dei Normanni and the *Soprintendenza Archeologica* of Puglia. In 2006 work began on setting up an archaeological area for visitors, funded by the 'Acri-Sviluppo Sud' project (see Semeraro 2009c).
- 6 This term indicates the presence of piles of stones. They may derive from the removal of stones from agricultural land or the presence of ruins. Often the word is associated with the remains of structures used as viewing platforms.
- 7 On the techniques used to carry out these analyses there is a rich bibliography, also available online. For an overview see, for example, Wheatley and Gillings 2002.
- 8 An exception is the cave ('grotta') of Ruffano, on the Serre Salentine hills. For the Archaic period, see the review of religious sites in Mastronuzzi 2005; for the Hellenistic period see Lamboley 1996.
- 9 At the moment the only cave used for religious purposes where anything is known of the cult (associated with Demeter) is that of Santa Maria of Agnano, near Ostuni (Coppola 1983; Burgers, Attema and van Leusen 1998).

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Surveying an Adriatic Valley: A Wide Area View on Early Urbanization Processes in Northern *Picenum*

F. Vermeulen and D. Mlekuz

Introduction

It is clear from many contributions in this volume that the integrated application of a set of non-destructive field survey techniques, in connection with more traditional approaches, can produce major insights into the content and development of urban sites in the Classical Mediterranean and beyond. In this paper we want to demonstrate that the combination of intensive integrated field surveys with exciting new computer-based means of data visualization can not only lead to rapid high resolution mapping and even virtual reconstruction of a single buried ancient town, but also to a far better understanding of long term processes of settlement change in a regional perspective and of relationships between ancient towns. Focusing on a particular case study in Adriatic Central-Italy, we will try to reveal certain long-term trends in urbanization that are inexplicable, and probably undetectable, at a local spatial scale or over the short term. We will address the important question of whether data quite recently acquired during a systematic survey project, specifically the Potenza Valley Survey (PVS, 2000–2010), and linked to older field data from existing archaeological databases, are adequate for a meaningful GIS analysis of spatial dynamics. Avoiding the trap that certain sophisticated technology can give a false impression of veracity and operate along lines of positivist certainty, we are convinced that a well balanced weighing of environmental components of the ancient landscape with social aspects of landscape formation allows a body of mainly field survey data to be the base for meaningful understanding of trends in landscape change. Especially for the pivotal period between protohistoric settlement clustering and true city formation, seemingly well documented and debated for first-millennium BC Italy, a spatial approach that gives as much weight to historical sequences or social factors as environment can address many crucial questions concerning past choices of site location and about success or failure of central places in the landscape.

State of the art

The research presented here concerns the northern part of the ancient Augustan region of *Picenum*, today essentially central Marche on the Adriatic side of the Italian peninsula. Within this area a series of quite narrow but fertile parallel valleys, linking the central Apennines to the Adriatic coast and separated by hilly interfluvia, dominate the landscape. One of these valleys, the 80km long corridor along the River Potenza, was chosen as a case study area for more intensive field research. This valley was from later prehistory onwards a much frequented corridor connecting Tyrrhenian and Adriatic Italy. During Roman times a *diverticulum* of the *Via Flaminia* connected Rome directly with harbour city Ancona via most of the Potenza Valley. Today this valley landscape is still only minimally covered by modern occupation, allowing intensive intra-site artefact surveys and offering good opportunities for remote sensing applications. Three large sample zones were selected for such detailed fieldwork, systematically spaced at regular intervals across the whole Potenza Valley, between the mountains and the sea. They cover the main landscape types of the region, generally coinciding respectively with the upper, middle and lower Potenza Valley, and are positioned in the vicinity of the four known Roman towns and of several of the now identified protohistoric centres.

The central objective of the first phase of the Potenza Valley Survey (PVS) project¹ (2000–2005), was to map all occupation from prehistory up to the Middle Ages within the valley and especially within the chosen research areas. A GIS-based multi-disciplinary approach was applied, using non-destructive methods such as remote sensing applications (in particular active oblique aerial photography throughout the valley and intra-site geophysical research), traditional artefact survey, in combination with a systematic geomorphological study of the research area.² As one of the main objectives of the project was to map long term settlement patterns, a high resolution line-walking survey technique was chosen. Site, as well as off-site densities were recorded on a systematic and detailed basis, allowing us to understand better the occupation patterns of different landscape units. On a series of large and complex sites, such as the four Roman towns and some large protohistoric sites and selected Roman rural settlements, detailed grid surveys and geophysical prospections were organized. These surveys are the core of the second phase of the project (2006–2010) with especially detailed intra-site city surveys on the four abandoned Roman town sites in the valley: the colony of *Potentia* on the coast and the *municipia* of *Ricina*, *Trea* and *Septempeda* in the interior. In the course of this field project also a re-analysis of some older excavation data was achieved as well as a reassessment and general mapping of all known sites and findspots in the whole valley (some 350 sites) which belong to the main period concerned here, that is from late Bronze age to the end of Roman dominance (Pignocchi *et al.* 2006). Before outlining the main results of this fieldwork and the principal patterns of occupation history in this

valley, and to some extent in the wider area of northern *Picenum*, it is logical to first specify the mental framework of our spatial analysis.

Methodology

We found inspiration for the broad theoretical framework for our study in the 'Time geography' concept. Time geography (Hägerstrand 1970; 1973; 1975; Pred 1977) is a powerful conceptual framework for understanding the human behavior in both time and space. In particular, it focuses on the constraints and trade-offs in the allocation of limited time among the captivities in space. The constraints that are imposed by the corporeality of the human existence mean that nobody can be at two places at the same time, that people have only limited ability to undertake more than one task at the time, that movement is time consuming and that every situation is rooted in past situations. Therefore, in time geography the physical mobility is not understood in isolation but instead as a component of a wider pattern of interaction.

The physical environment where agents move, interacts with the capabilities of agents, and therefore plays an active role in shaping their actions and the outcomes of their actions, thus being effectively an agent in the history of unfolding relations between people and people and environment. People tend, for various reasons and in various temporal scales, to move regularly in similar paths in time and space, for example, going to work on a field, traveling to the market, herding sheep, etc. Social practices or routines are normally conducted at definite places and at given moments, although some may extend over long periods of time. Therefore, social individuals tend to follow recurring time-space paths in their day-to-day lives. These routine practices are shaped by various forms of constraints, for example, the need for regular sleep and food, seasonal requirement of plants or animals, availability of tools, availability of other agents and constraints imposed by the landscape itself. The routine practices of course also change stations where they occur; they leave material traces which create new constraints in the process. In this way they have a structuring effect on future practices that occur at the station or in the vicinity. Therefore, landscape itself, modified by past human activities, is an active agent in the unfolding relations between people and people and landscape.

For example, we are interested in the differential access to central places in the landscape (such as towns and the functions they provide) and how landscape architecture, such as bridges, communication lines, etc., structure the movement and organization of people.

In the light of this, it is also important to understand how Roman politics, materialized in the landscape, structured by daily activities, paths and projects. How did the daily project reflect and reproduce those politics and how did the landscape itself define the ways politics manifested themselves? How did the practices rooted in the past, and materialized in a landscape,

served to change the landscape? Constraints of the landscape (topography, rivers...) were all important, but also created new constraints which structured differential access to the resources. Therefore, the Roman landscape cannot be understood in simple terms of organization, control, domination and optimal behavior. Instead, its logic is deeply rooted in the past landscapes and the Roman landscape a result of resistances and agencies of indigenous people. So when looking at the Republican or Imperial landscapes in Italy, we must first understand the structuring of the regional protohistoric landscapes and the role of the pre-Roman central places. The Roman town is an important component in the spatiality of the imperialism of that time. It was through towns that control over landscape was exercised and through towns that the monumentality of empire and the material of its power was displayed. However, the Roman towns did not emerge *ex nihilo*, but superseded the indigenous ways of organizing landscape, ultimately controlled and steered by Rome.

Results

Protohistoric landscapes

Protohistoric settlement of the Potenza Valley is mainly associated with *Piceni* populations, as known from classical sources (Naso 2000). The ethnic attribution of specific sites is problematic, however, especially in the Apennines and Pre-Apennines, where there is also an *Umbrian* presence and is further complicated by the development of Greek colonies and emporia on the coast (Ancona, Numana) and by small Gaulish migrations into northern *Picenum*. The characteristic trait of *Picenum* in the Iron Age (ninth–third century BC) is, therefore, a high level of interaction with the neighboring regions, as the evidence from wealthy burial places suggests. These include prestige items that circulated in the Mediterranean exchange networks such as amber, bronzes and pottery of Greek origin or style.

On the other hand, the settlement evidence is much more sparse and difficult to interpret. The (early) sites are usually small and ephemeral, consisting of archaeologically poorly visible wattle and daub huts. The household that inhabited a single hut for one generation might have discarded less than hundred pots, which today can be represented by only a few sherds in the surface record. The shift to more substantial buildings, with foundations made of river pebbles and covered by ceramic tiles, happened around the sixth century BC and can be attested on larger aggregated sites only, such as Matelica, situated directly north of the Potenza corridor (de Marinis and Silvestrini 2005). The older huts might have persisted much longer in the countryside and remain harder to detect by way of survey. Another problem that is difficult is the chronological attribution of settlements: locally produced coarse pottery (*impasto*) is non-diagnostic and sites with no

fineware or imported items can only be broadly attributed to the 'Iron Age' (Boullart 2003; Riva 2007).

On the basis of the PVS data, Iron Age sites can be distinguished broadly into three groups (Boullart 2004; Boullart and Vermeulen 2005), with the first and most common group represented by concentrations of few thick, crude, dark-reddish coarse pottery (*impasto*) found in areas up to 300m². They might represent short-lived, single phase farmsteads. The surface distribution of pottery is often associated with darker grey soil or even spots which could be remains of ploughed-up pits, where sometimes even fragments of animal bones (pig, cattle and sheep/goats) were found. The sites are often associated with (palaeo-) water springs (Boullart and Vermeulen 2005) and seem much dependent on environmental factors.

The second type is represented by larger sites composed of clusters of higher density within the uniform carpet of sherds. The best example of this type is an aggregation on the east slope of the middle valley hilltop site of Monte Franco (near Pollenza), where several concentrations of Iron Age material occurred, associated with patches of brown– grey coloured soil. There are several indices that this is a settlement site with more substantial buildings: such as the presence of river pebbles, Iron Age roof tiles and pieces of sandstone. The surface assemblage is dominated by *impasto* pottery, however there is also imported painted pottery, *buccherio grigio* and fragments of Greek pottery. We might interpret the site as an aggregated village that controlled the passage under Monte Franco, and can be seen as a part of the larger complex including the wealthy Moie di Polenza burial ground in the vicinity, which emerged around the late Bronze Age hillfort on Monte Franco.

This type of site might be the result of the process of aggregation of small hamlets into larger composite villages. We have good excavated evidence for this process in Matelica, where several settlements of different sizes occur, with an average distance of approximately 1.5km to each other and each with its own burial grounds. The location of these clustered living areas in the valleys, without defence, seems to suggest a full control over the territory and possibly even over some of the nearby Apennine passes (de Marinis and Silvestrini 2005: 139). There is some evidence that a similar situation might have occurred around Treia, where a number of protohistoric settlement foci have been encountered in the immediate vicinity of the Roman town of *Trea* (Vermeulen *et al.* 2009: 102–104). Both the composite village of Matelica and the site near Treia are located on an important communication route towards Ancona.

In the third group we find large hillfort or sanctuary sites on the most prominent locations in the landscape. One example is the Monte Primo mountaintop site, on an elevation of 1300m, situated immediately above the Pioraco gorge. Limited excavations (Lollini 1971) have yielded mostly Bronze Age material with some evidence of Iron Age presence. A series of

enclosures incorporates an area of a few hectares. It can be interpreted as a periodical aggregation site for special activities (feasting, cattle assembling, etc.) or sanctuary, or both (Bonomi Ponzi 1992). Such mountaintop sanctuaries are typical for the central Apennines, especially in *Samnium* and *Umbria* (Letta 1992; Conati Barbaro *et al.* 2004).

Another site, the Picene hillfort on the top of Monte Pitino, near San Severino Marche, has a large tiles and pottery cover over an area of almost 10ha, which is comparable to the size of the nearby later Roman towns of *Trea* and *Septempeda* in this area of the middle Potenza Valley. Excavations on the summit have also produced evidence of structures and ceramics from protohistoric and the late Republican periods, but these are poorly recorded (Lollini 1958). The strong presence of protohistoric roof tiles within the assemblages found through systematic field walking in the PVS and indications for important enclosure systems (Boullart, Vermeulen 2005; Vermeulen *et al.* 2009) suggest a nucleated settlement rather than periodically visited places. The hillfort is surrounded by cemeteries which yielded some very wealthy graves (Conati Barbaro *et al.* 2004; Vermeulen *et al.* 2009: 106–108).

We might suspect the presence of a similar hillfort under the modern town of Recanati, located on a prominent hilltop at some 10 km from the coast and again surrounded by several wealthy Picene burial places (Percossi Serenelli 2003).

Nearby, above the mouth of the Potenza River on the plateau of Montarice hill, an extensive protohistoric settlement site was recently identified (Vermeulen *et al.* 2003). The cropmarks seen via our aerial photography, reveal the presence of enclosures as well as internal structures such as rectangular houses, pits, and possible wells. Surface survey yielded large evidence of structures (wattle, stones), and a large number of Middle Bronze–Late Iron Age pottery, including some Greek imports. The position of the site, with control of the coast and river, suggests that it might have played an important role in the control over exchange of goods with nearby Greek settlements (such as at Numana on the Monte Conero) and hinterland communities.

We might assign to all of these sites of the third group a pivotal role as central places with political and commercial as well as religious functions. This aggregative quality makes the analysis of mountain- and hilltop sites valuable for the study of social dynamics changes in the communities of pre-Roman *Picenum* (Stek and Pelgrom 2005)

Looking at the general picture now of patterning and site density throughout the Iron Age (Figure 20.1) some final comments can be made for this period. We estimated the densities of Iron Age settlements within the three PVS sampling transects, in respectively the upper, middle and lower valley, as the number of detected sites per area of actually surveyed fields. The densities between sampling zones are comparable, with around 2 sites per

km² in the upper and lower valley zones, and around 3 per km² in the mid-valley zone. However, there are marked differences in the structure of settlement patterns. The calculations, using kernel density estimation,³ show a low and patchy distribution of sites, which nonetheless covers the whole landscape and is more dense around the hilltop sites. It appears that the Iron Age countryside was dotted by small, dispersed settlements. This pattern was clearly structured around prominent places in the landscape such as hilltop settlements that might have been seats of élites and sometimes also served as sanctuaries, places of memory and commemoration. This pattern probably had its roots in the social settlement structure of the later Bronze Age. On the other hand, we can observe a process of aggregation of hamlets into larger composite villages, especially on the communication corridors in lowlands. This process probably led to the formation of proto-urban settlements. The villages might have been place of new élites that gained power through control of exchange networks and distribution of prestige goods. Parallel with the role of the important emporia of *Spina* an *Adria* in the northern Adriatic, on both sides of the Po-mouth, we see that in this period some Picene centres seem more and more involved in contacts between Greeks and Etruscans. Of particular importance are the Etruscan towns of *Volsinii*, Perugia and Arezzo and the Eastern Greek Phocaeans who started to play a major role in the western Mediterranean and the Adriatic Sea. Athens too seems to become increasingly involved in this transapennine trade with the Etruscans, as is clearly demonstrated by the relatively high numbers of finds of Attic pottery in the main river valleys of the area, such as the Potenza Valley (Baldelli 2004: 54). All this indicates rich internal dynamics of Picene society at least since the Orientalizing period, when *Picenum* became tightly interwoven in the Mediterranean world system.

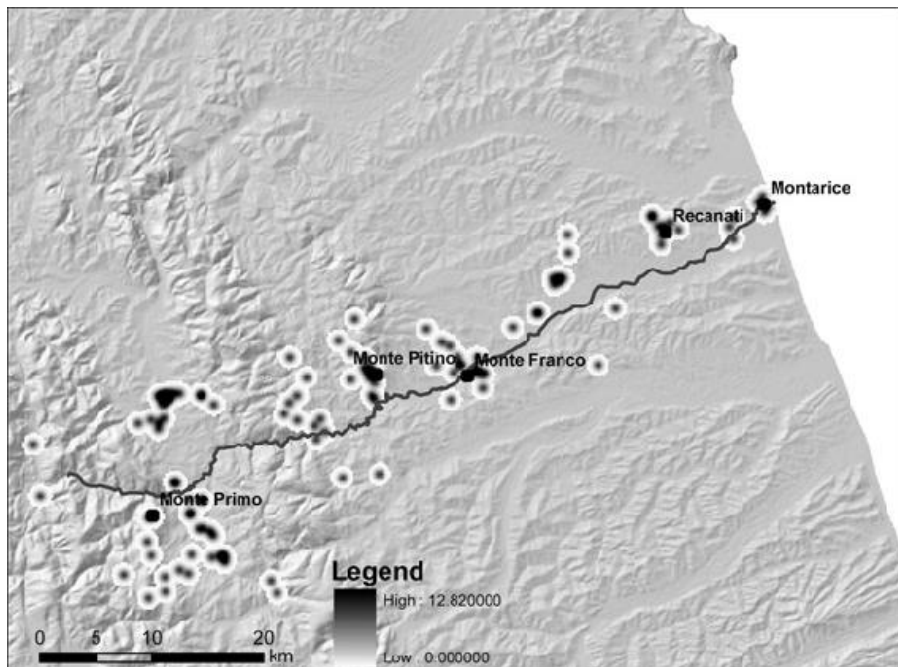


Figure 20.1 Density of Iron Age sites in the Potenza Valley calculated using kernel density function. The position of major hilltop settlements or/and sanctuaries is indicated.

As is well known, this proto-urbanization concept is quite crucial in Italian protohistory. It describes the spatial, economic and social processes that began in the later Bronze Age and led in many regions of the peninsula to the formation of centralized settlement in the Iron Age and Archaic period. It has been convincingly demonstrated in areas such as Puglia, Lazio and Tuscany, that the choice of favourable locations in the landscape, such as on hilltops or near transport corridors, was an important step in the formation of such proto-urban centres, as settlement in the course of the Iron Age and immediately after often clustered in such places (Peroni and Trucco 1994; Vanzetti, 2004).⁴ However, although the northern Picene area was surely part of such larger Italic evolutions towards full urbanism, in this area of Italy only the full incorporation into the Roman world after the mid-third century BC triggered the appearance of real cities.

Roman landscapes

The Roman countryside

Survey in the Potenza Valley during the last decade, and the re-assessment of old finds data, allows us today to have a certain understanding of distribution patterns in this subregion of Roman *Picenum*. Elsewhere we have assessed the chronological evolution of rural settlements in the landscape, between the Late Republic and Late Antiquity (Verreyke and Vermeulen 2009; Vermeulen forthcoming). Here we would like to analyze further the overall site density

and propose some considerations about the general rural spread of occupation in the valley landscape under Roman dominance.

The density of Roman (settlement) sites was calculated using the survey data of the three PVS sampling zones (1. upper valley, 2. mid-valley and 3. lower valley) (Figure 20.2, Table 20.1). We calculated the density of sites as the number of sites per area of actually surveyed fields.

In the upper valley zone (near Pioraco) the density of Roman sites is the highest, with more than 11 sites per km²; in the lower zone around the city of *Potentia*, the density is around 8 sites per km²; while in the middle valley zone next to the Roman city of *Trea*, density is very low, 3.73 sites per km². If we compare this to the protohistoric pattern, which covers a period of almost the same length, we can directly observe that the density of Roman settlement sites is much higher and much less uniform between zones. There are also marked differences in the structure of the settlement pattern. Verdonck and Vermeulen (2003) have separated the sites in seven types, apart from the towns, six of these are essentially part of the rural landscape. We summarize them here.

	TRANSECT		
Site type	1	2	3
House unit	9	2	6
Small farm	14	3	4
Large farm or simple villa	10	2	6
Villa	2	3	7
Roadside settlement	0	1	1
Vicus	0	1	0
Other	2	2	9
Total number of sites	37	14	33
Area [m ²]	3154335	3754675	4007254
Density [site/km ²]	11.73	3.73	8.24

Table 20.1 Numbers of well dated Roman rural settlement sites in the three PVS survey transects (1 upper-, 2 mid-, 3 lower- Potenza Valley).

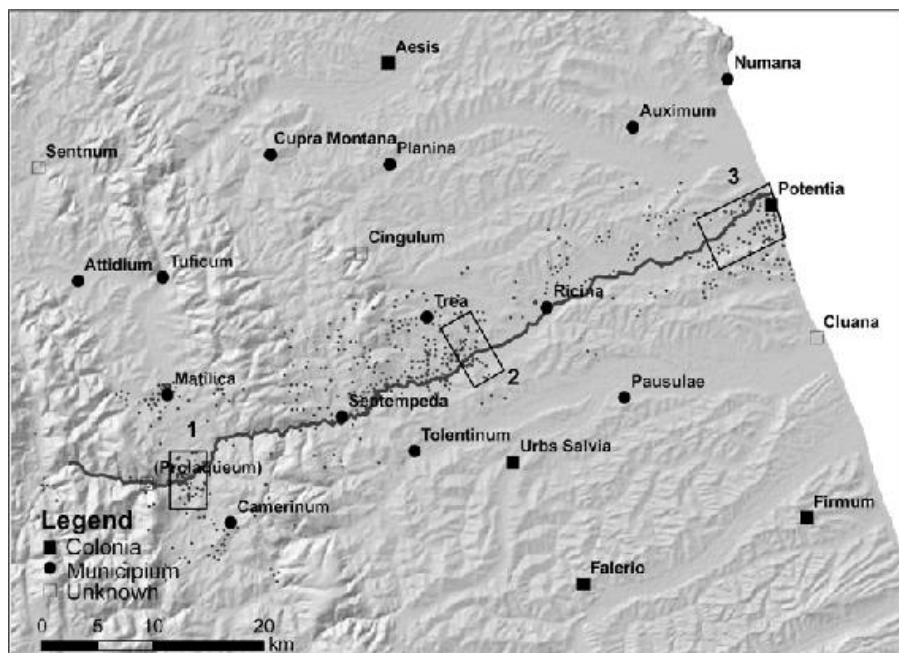


Figure 20.2 Position of Potenza Valley survey transects versus the distribution of all Roman sites in the valley.

Type 1, is represented by scatters of tiles and pottery not larger than 1200m², but usually smaller than 700m². Usually, no fine wares are present. These sites might be interpreted as ‘small farmsteads’ or even ‘temporary settlements’.

Type 2 sites are larger, with scatters sized between 1200 and 2500m², composed of building material and different pottery types, including finewares. They might be interpreted as ‘small farms’, as they show no internal structure or high densities of pottery. This was further supported by aerial photography, which in one case revealed crop marks of a single rectangular building with dimensions of 25 × 20m and several internal rooms centered around a courtyard.

Type 3 concentrations are even larger, from 2500 up to 4000m², with distinct clusters of only building material or greater concentrations of pottery. Few luxury items are present. They can be interpreted as ‘large farms’ or ‘simple villas’.

Type 4 is rare and can be interpreted as a ‘villa’ in the widely accepted archaeological sense of the word. They are represented by large concentrations of pottery and building remains, sized up to 6000 m². The assemblage includes among usual brick, tiles and stone fragments, also well cut stone (sandstone and limestone), and some elements which can be interpreted as a particular display of wealth, such as marble *crustae*, mosaic *tesserae* and fragments of columns.

Type 5 sites have similar signatures as the farms (types 2 and 3), but have a

somewhat different composition of pottery assemblages, especially a high proportion of tablewares, amphorae and lamps. Their location, associated with roads suggests that they can be interpreted as roadside settlements, maybe even (partly) functioning as inns or taverns.

Type 6 is represented by one site only, located in the mid-valley zone. It is similar to type 5, but larger. Large concentrations of Iron Age pottery and the presence of *Piceni* burials immediately to the southwest suggest continuity from the Iron Age. The position of the site near the strategically important pass through the Potenza Valley, near the bifurcation of the road towards *municipium Trea*, presence of a large number of Iron Age sites and the important Iron Age élite sites of Monte Franco in the immediate vicinity, suggests that this might be interpreted as a *vicus*. Recent rescue excavations here have identified several building units dispersed in clusters (Vermeulen *et al.* 2009).

The structure of settlement within each sub-region differs significantly. Thus in the upper valley type 2 (small farms) dominate the record, with almost 40% of sites classified as such, however in the mid-valley and lower valley zone farms of all types (including villas) are represented rather uniformly. However, the low density of sites in the mid-valley sampling zone seems to be anomalously low, especially if we compare it to the density of sites located in this general area before the PVS project started (Moscatelli 1988). The database of sites for the whole Potenza Valley, including intermontane zones between the Roman cities of *Matilica* and *Camerinum* was collected by the Soprintendenza per i Beni Archeologici delle Marche in collaboration with the Ghent team (Percossi *et al.* 2006). While the quality of the data is generally low, since many sites were discovered and initially studied in an unsystematic way, it can serve as a useful reference to which the PVS sites can be compared. The large number of Roman sites (*c.* 300) means that it can provide useful clues about the settlement pattern of the whole valley.

To calculate the density of sites as a continuous raster map we used the kernel density function (Figure 20.3). The density of sites varies considerably, from 7.5 sites/km² in the intermontane zone between *Matilica* and *Camerinum*, around 4 sites/km² between *Septempeda* and *Trea* and 3 sites/km² around *Potentia*. We can observe that densities of sites are generally higher around towns, however, except around *Potentia* they do not form a distinct ‘fall-off curve’, with higher densities around the towns and decreasing away from them. On the contrary, there seem to be clusters of sites away from towns and not related to towns. This is especially true for the area between *Septempeda* and *Trea*, where a large cluster of rural settlements can be observed in the valley, on the terraces along the Potenza River. Even more curious are areas on the map, where density is very low or where there are no sites. This is especially true for the area around the city of *Ricina*, which almost lacks rural sites.

The PVS sampling areas are located on or near the high density clusters of sites, and seem to correspond rather well with the densities calculated from the old data. The only difference is in the mid-valley sampling zone, where the PVS density is lower than expected from the old data density. However, the PVS sampling zone is located just on the edge of the cluster of sites recognized on the old data density map and might reflect the border of the distinctive cluster of sites. If this is true, then we have evidence that the landscape was not uniformly settled but covered by rather well defined clusters. In some cases this might be associated with regular land division or centuriation. For instance, in the area south of *Trea* there seems to be a higher density of especially late Republican and first century AD settlement sites connected with such a regular land division, to be attributed to newcomers settled here during the Triumvirate period (Moscatelli 1988). This observation seems to contradict the idea that there is a strong continuity in settlement pattern in this region, unless such centuriations targeted already used landscapes where high productivity was guaranteed, as was recently suggested for the centuriations in the lower Potenza Valley, between *Potentia* and *Ricina* (Corsi and Vermeulen 2010). In general we must observe this seemingly curious feature that the countryside did not especially develop around the Roman towns, in particular in the mid- and upper valley zones. It looks as if towns adjusted to a pre-existing settlement pattern here. This might indicate a strong continuity of countryside settlement from the Iron Age, except in the lower valley, where the occupation of the rural landscape boosted around the colony of *Potentia* with its more systematically exploited, more widely centuriated landscape, whose carrying capacity was surely enhanced thanks to the exploitation of the coastal environment.

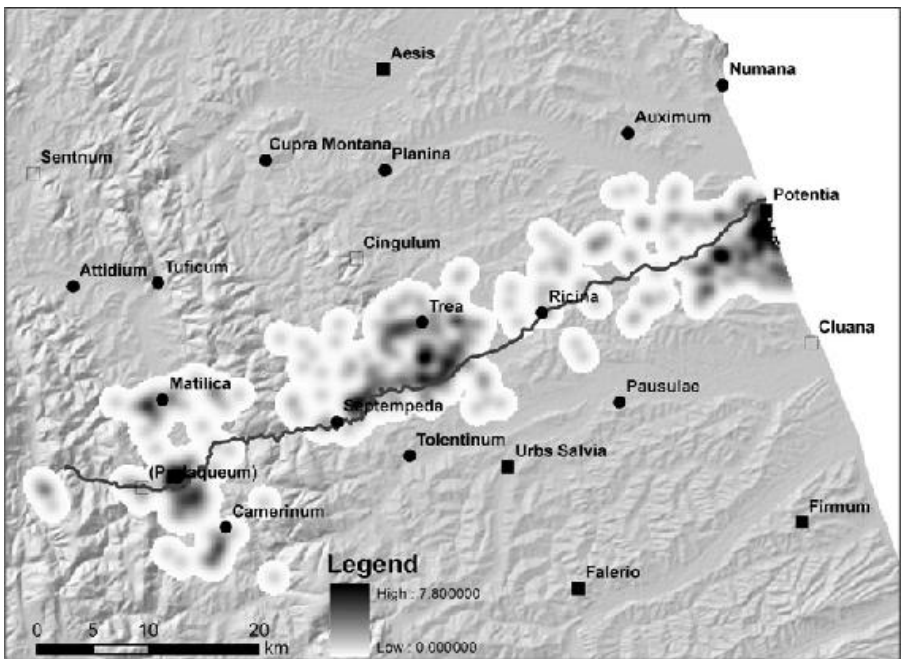


Figure 20.3 Density of Roman sites in the Potenza Valley calculated using kernel density function.

The Roman towns

The recent inventory of 35 Roman towns known in the Marche region (Luni 2003) and some 23 self-governing towns in the area of 6000km² identified as *Picenum* (De Ligt forthcoming) was taken into account for a wide area approach of the urbanized landscape of especially northern *Picenum* (Figure 20.4). *Picenum* had a dense urban network.⁵ The average distance between towns in this region was 13.5km, which is only slightly higher than the corresponding figure for *Latium* and *Campania* (De Ligt forthcoming). The average nearest neighbour distance between the towns in northern *Picenum* is even shorter, around 10km, but it varies from 7km to 18km, although this larger number can be a result of border effect. The sizes of territories, calculated using Thiessen polygons, vary from 65 to 665km², although large sizes are definitely a result of the border effect. Most of them have territories below 200km². The overall high density of towns in this part of Italy was surely convenient for most people living in the countryside, since the nearest town was generally located at less than two hours walking distance (Figure 20.5).

The Roman towns in northern *Picenum* have, however, very different biographies. Some coastal towns grew from Greek settlements or *Piceni* settlements with strong Greek contacts and presence (e.g. *Numana*, *Ancona*). There is a series of newly founded Latin or Roman colonies with a subsequent influx of Italic populations, especially on the coast and near important road

connections (e.g. *Firmum*, *Auximum*, *Potentia*, *Urbs Salvia*). However, in the hinterland, especially in the Pre-Apennine zone, there is a dense network of small towns with only municipal status that emerged for the most part from pre-Roman settlements. This suggests that the pattern of Roman towns emerged most of all from the protohistoric population and possibly reflects the political situation of the *Piceni* at the time of the mid-third century BC conquest. At least for some Roman towns continuity from Iron Age settlements can be assumed or proven. Thus, the city of *Matilica* succeeded the aggregation of protohistoric settlements and cemeteries, which most probably functioned as a central place in the intra-montane basin near the Apennine foothills. The same is suspected for the inner Potenza Valley towns *Trea* and *Septempeda* (Figure 20.6, Table 20.2) and especially for some well located hilltop sites such as *Cingulum* and Umbrian *Camerinum*. On the other hand, some nucleated settlements did not gain the status of *municipium*. An example in the Potenza Valley is the site on Monte Franco, which despite its strategic position and evidence of aggregated, élite controlled, protohistoric settlement never evolved into a Roman town but probably stimulated the development of a nearby *vicus* (at Passo di Treia) once the Roman road system became established.

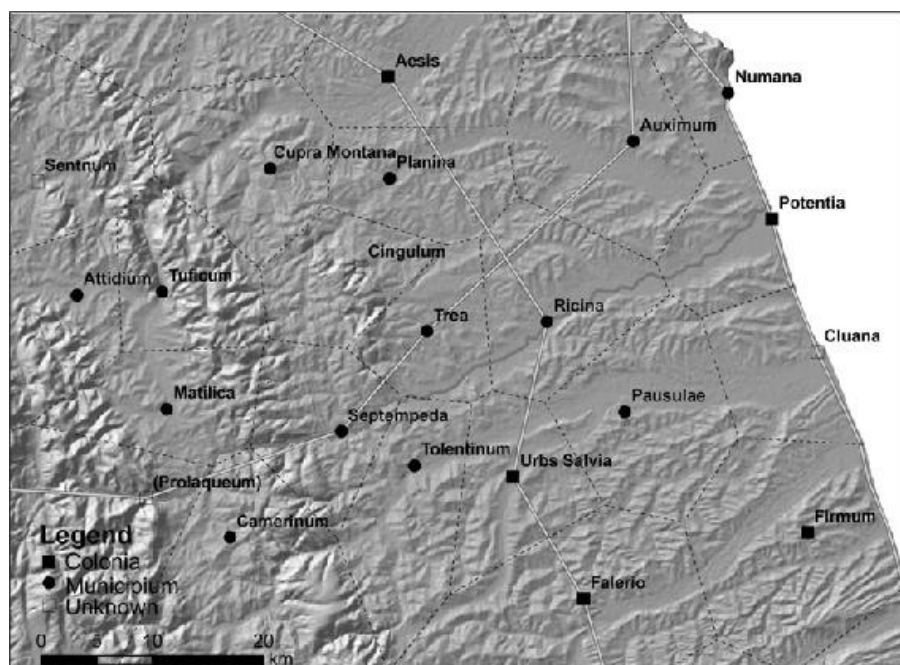


Figure 20.4 Wider study area in northern Picenum with Thiessen polygons around Roman towns and main communications.

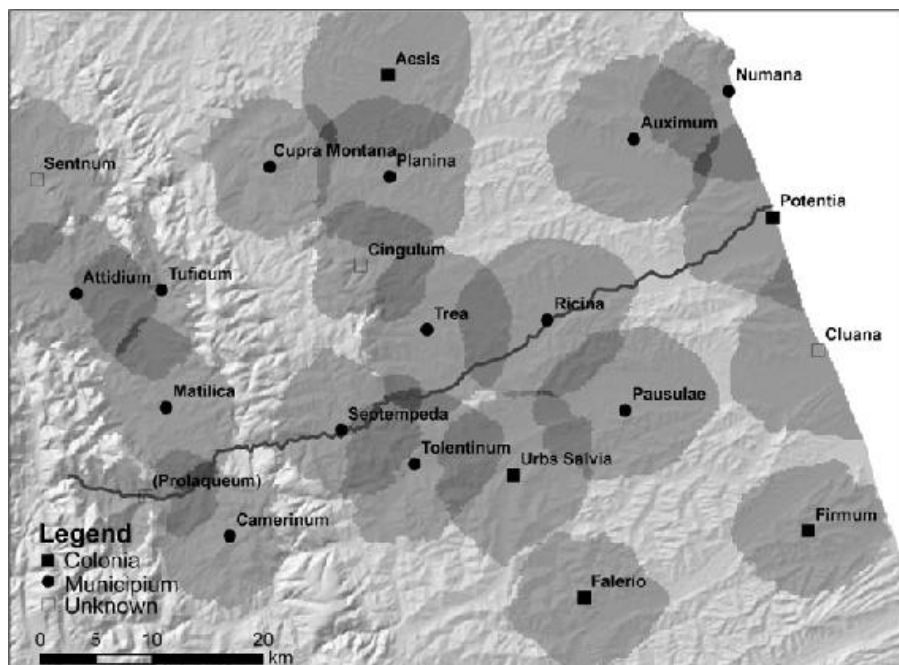


Figure 20.5 Two hour walk isochrones around Roman towns in the study area.

It appears that the pattern of *Picenum's* Roman administrative division, probably finalized at the time of Augustus, and above all the spatial positioning of towns reflect very specific historical situations, which developed from the time of conquest to the new stability reached in the course of the first century BC. This would imply that not some long-term logic of availability of agricultural land and natural resources, such as water, wood and minerals, and the search for places with visual control over the landscape, were the dominant factors in this evolution. However, this might be putting things too strongly into a political and social-historical explanation. Long-term patterns surely played an important role in the development of *Piceni* settlement patterns and the Roman administrative system was also established to effectively control and redistribute the agricultural production of the region. Until the beginning of the first century BC, towns were not of major importance except where Latin and Roman colonies had been founded by Rome, such as at several strategic places along or near the coast. When, however, the Italian allies of Rome acquired Roman citizenship as a result of the Social War, the élites in many parts of Italy began to transfer their attention to the city of Rome and to political competition there (Patterson 1987). Accordingly, they began to build in the newly created *municipia* and neglected the old *pagi* and *vici*. This must have resulted in *Picenum*, during the first half of the first century BC, in a gradual decline of the *vicus*-based system and in some 'urban' development in many parts of the interior. It is precisely in that period that we see the gradual rise in the Potenza Valley of

the *municipia* of *Septempeda*, *Trea* and *Ricina*. These sites, and others in northern *Picenum*, were probably (gradual) relocations of population centres in better suited areas, where full advantage could be taken of the economic possibilities of the road and fl uvia l transport system (Vermeulen forthcoming).

	STATUS	INTRA-MURAL AREA [HA]	HINTERLAND AREA [KM ²]
<i>Potentia</i>	<i>Colonia</i>	18	112
<i>Ricina</i>	<i>Municipium</i>	22	197
<i>Trea</i>	<i>Municipium</i>	12	121
<i>Septempeda</i>	<i>Municipium</i>	15	149

Table 20.2 Potenza Valley town sizes

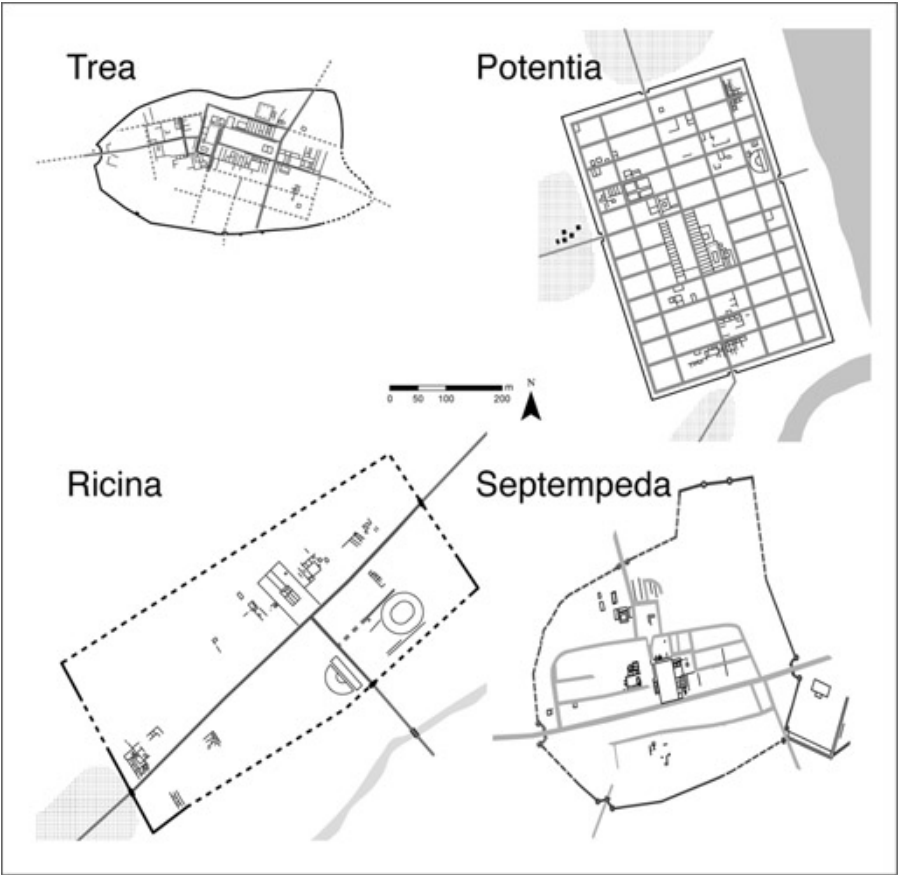


Figure 20.6 Comparison between the four Potenza Valley Roman town plans. Provisional mapping based mostly on intensive intra-site survey by the PVS project and some older excavation evidence (maps by the authors, with the help of G. Verhoeven and F. Carboni).

Mobility and accessibility

From the later second and especially first century BC onwards the thorough exploitation of the countryside by, amongst others, new urban élites, and the fact that the new central places were developing more and more into 'consumer' cities in relation to their territories, must have placed intra-territorial connections at the forefront of economic success. Although the expansion of Roman roads since 220 BC in this area first followed military developments, they soon became a new and privileged means of communication between different areas of the peninsula, radically transforming the existing market system and generating new routes to serve Roman interests. The nodes of this network were formed by the new Roman and Latin colonies and both roads and cities played a major role in the emergence of a new political identity, contrasting with the character of indigenous intraterritorial connections (Laurence 1999; Curti 2001). From Augustus onwards the Roman roads became an imperial project, inscribing a pattern of order on the landscape, and a way of directing people between towns and road stations (Corsi 2000). Still, these roads were also much structured by the landscape itself, with its hills, ridges and valleys; indeed, this landscape factor is, for rugged *Picenum*, of major significance in comprehending fully the structures of mobility and accessibility.

Major roads attested in the ancient sources, especially the *Itinerarium Antonini* (Delplace 1993) are the *Via Salaria* which provide south–north communication along the Adriatic coast, connecting the important cities of *Potentia*, *Numana*, *Ancona*, *Sena Gallica* and *Pisaurum* (where it joins the *Via Flaminia*) and the *Via Salaria Gallica*, which connected the inland towns of *Forum Sempronii*, *Suasa*, *Ostra*, *Aesis*, *Ricina*, *Urbs Salvia*, *Falerium* and *Asculum* (Figure 20.4, above). The *Via Flaminia* connected Rome with *Ariminum* on the Adriatic coast, contouring *Picenum* on its western flank, but the important *Via Flaminia per Picenum Anconam* is a *diverticulum* from the main Rome–Rimini road, leading via *Septempeda*, *Trea* and *Auximum* towards Ancona, hereby crossing most of the Potenza Valley. Apart from those main axial connections, the landscapes were surely crisscrossed with roads of lower rank, tracks and pathways that connected the countryside with the towns along mostly 'natural' lines. In order to model the networks of roads, tracks and other communications between towns we created a GIS-based model of the communication network (Figure 20.7). Each town was connected with each other town using least cost paths. The friction surface was expressed as a function of time needed to traverse the raster cell by Tobler's function⁶. Additionally, an effect of noise was added, by randomly changing the friction value of 10% of raster cells. For each pair of Roman towns, 20 optimal paths were calculated. These were added together into a cumulative map of all possible communications. Therefore, cells with higher value represent areas where more paths converge, enhancing the possibility that a communication route actually passed the cells. The resultant map represents the maximal

possible communication network. In reality, there were probably much less actual roads and communications, as new roads reused the existent road network and some of the roads converged.

The resultant map does not provide a map of actual communications, but offers a guide to where some kind of land communication might have passed. However, the map can reveal several interesting patterns. Thus, for example, we can observe the emergence of crucial corridors for communications. One of the most prominent communication corridors runs along the Potenza Valley, leaving the Apennines through the gorge of Pioraco to the coastal town of *Potentia*. This corresponds essentially to the historically attested *diverticulum* of the *Via Flaminia per Picenum Anconam*. Another important corridor runs along the Adriatic coast, corresponding with the *Via Salaria Gallica*.

Cumulative optimal path maps can reveal the existence of nodes, places with central, and well connected positions. An important node is the Roman town *Ricina* which channels the communication along the Potenza Valley, but also bundles a number of north–south connections. This reflects an important position of *Ricina*, not only as a crossroads of the *Via Salaria* with the extension of the *Via Flaminia per Picenum Anconam* towards *Potentia*, but also as a true central position from where many other towns can be easily reached. In this way the central position of *Ricina* played the role of gateway from the coastal towns (not only *Potentia* but also *Numana* and even *Ancona*) to the network of *municipia* in the Pre-Apennine and Apennine zone. The recent discovery at *Ricina* of a monumental Roman bridge structure, crossing the Potenza river (Vermeulen *et al.* 2005), adds importance to this node. It is clear from this example that the building of bridges, as a deliberate political action, played an essential role in communication and accessibility in this landscape. As the landscape of northern *Picenum* is an environment that directs the movement into well-defined corridors, the position of central settlements and bridges within the network can play an important role in the development of the settlement pattern. The existing communities that are well positioned in this can funnel more people, goods and substances and can therefore profit from their location. The organically-developed system of communications of pre-Roman date has in this way developed into a well organized, state and city-sponsored system of roads with regular inter-distances, with the implementation of monumental constructions such as bridges, with shifts in religious foci (temple sites now lying closer to the roads) and especially with better access to the towns and their many facilities.

Roman towns were places where flows of people and substances congregated. In this sense, a town can be seen as a station where bundles of activities occur and where possibilities are being created for other activities to occur in the vicinity. Therefore, they do not only provide the functions and facilities to their inhabitants only, but structure the pattern of activities and its material residue in the wider landscape. Cities were recognized as central

features of Roman imperialism and the preferred form of social, political and administrative organization throughout the Empire, not only providing Rome with a hierarchic governing framework (Perkins and Nevett 2000), but also as the location where civilised people, especially those adopting a 'Roman way of life', dwelled (Whittaker 1997; Lomas 1998; Laurence 1998). The growing wealth of the *Piceni* élite and the gradual growth of the towns as significant central places are responsible for an almost continuous prospering of municipal life during the first and large part of the second century AD. The towns are provided with theatres, temples, aqueducts and public baths. Created originally as somewhat artificial administrative centres, they became flourishing centres of population, and hence of marketing and exchange, real magnets for strong ties between town and territory. Still it is striking and most interesting that not all the Roman towns provide the same functions. We can assume that all of them shared the necessary attributes which define a town (such as walls, market, forum with justice hall and temple) and provided basic socio-economic, commercial and administrative functions. However, there are huge differences between towns. In *Picenum* it seems that cities can be different in terms of town size, size of their territory, as well as in other town attributes, such as presence/absence of thermal structures (public baths), temples, theatres and amphitheatres and other monumental architecture (Table 20.3). This pattern reflects differences in élite investment and financial input from outside, but also the different ways towns were connected with their countryside. Towns not only provided the services for the town based population, but also for the wider population that was based in the suburban areas or the surrounding countryside.

Above we stated that because the overall density of towns in northern *Picenum* is very high, it is possible to reach the nearest town from most of the countryside within a two hours walk, and a very good percentage of landscape is even accessible within a one hour walk from the centre (Figure 20.5, above). This might explain why, for example, the size of Roman amphitheatres and theatres, often with reason used as a base for demographic calculations at a certain moment of the town's life, were much larger here than estimated town populations. For example, the amphitheatre in *Urbs Salvia* could accommodate around 5000 spectators, which is probably much larger than the whole population of that colonial town. However, it will have fulfilled certain needs of accommodation of larger masses of people, involving the rural populations from its territory at religious festivities (Luni 2003: 244–245) (Figure 20.6).

These buildings of entertainment thus might have served as powerful magnets to attract the countryside population into cities. By attracting people into towns for major holidays and celebrations, they provided a setting for the containment of people. Containment is a technology of power, which together with *fora*, *macella* and other crucial city facilities can be seen as a technology of control. They provide a physical envelope for a setting, separate the outside

from the inside, and provide prescribed ways of movement and behavior. They can crowd people, animals, things and substances together, mix them, and hide them from view. Thus theatres do not only provide a physical setting for the indoctrination of people through display and performance of monumentality and spectacles, but structures where people become obedient subjects by embodying the imperial ideology through prescribed movement, postures, etc. (cf. Foucault 1975; Gros 1996).

However, the distribution of amphitheatres and theatres in a Roman landscape is not uniform, and in a region such as *Picenum* many towns probably lack these structures overall. Most permanent spectacle buildings are associated with towns with a significant influx of Roman populations, in particular towns with a colonial status or with a very strong integration in the supra-regional network (Figure 20.7). Here more investment by élites is likely and investment in such popular buildings was one of the obvious choices. In areas where such well-integrated towns occur – for our study region that is between the mid-valleys and the coast (Figure 20.8) – the density of amphitheatres and theatres is normally quite high, and people have access to up to four theatres within a four hour walking radius.

	POTENTIA	RICINA	TREA	SEPTEMPEDA
Forum	x		x	x
Temple(s)	x	x	x	x
Basilica	X?		x	
Macellum	x		x	X?
Tabernae	x	x	x	x
Theatre	x	x		
Amphitheatre		x		
Thermae	X?	x	X?	x
Aqueduct	X?	x	x	X?
Sewer system	x	X?	X?	X?

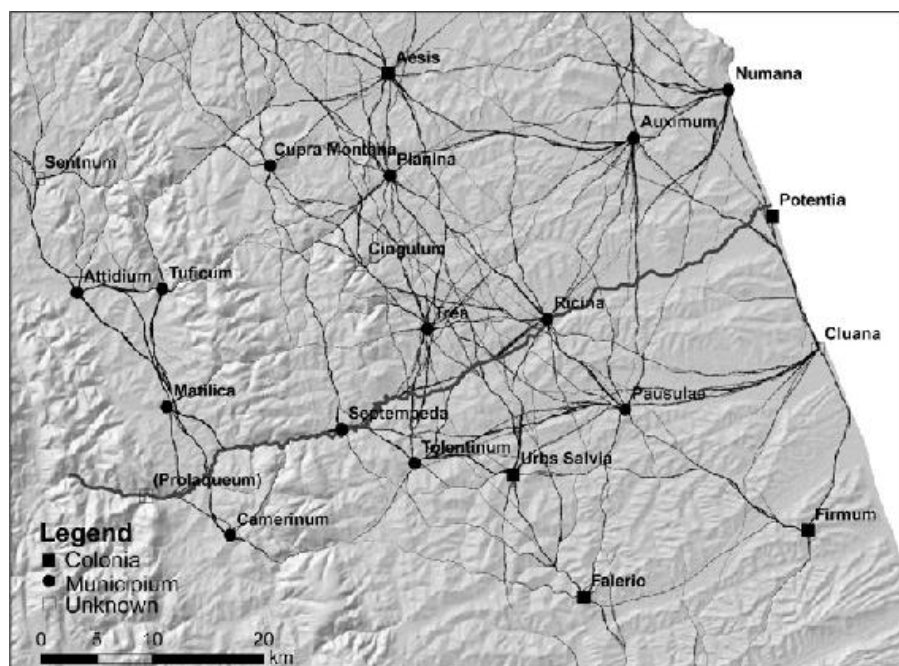
Table 20.3 Potenza Valley towns: urban infrastructure identified through the PVS survey (mostly) and some older excavations. All towns are walled.

The dense pattern might indicate the competition between towns to attract more people and have wider influence over the countryside. On the other hand, almost all inland *municipia* of northern *Picenum* (and the southern edge of the *Ager Gallicus*) seem to lack theatres and amphitheatres. For the inhabitants of this interior *Picenum* theatres lie outside the four hour walk isochrone, therefore, rendering it physically impossible for them to visit within one day return trips. One possible explanation of this peculiar pattern is that the spectacles and festivities associated with these buildings were consumed in different ways in inland towns with strong continuity from Iron Age than among the more ‘Romanized’ populations living closer to the coast. Alternative ways to celebrate festivals for them might have included processions and congregations on important places in the sacral landscape, such as at mountaintop sanctuaries. The continuity of such celebrations and

sacred places might represent a resistance to the process of Romanization and a way to negotiate their specific Picene or Umbrian identity, even as Roman citizens.

Conclusion

This study has given us the opportunity to investigate the potential of certain types of spatial analysis for a better understanding of landscape dynamics in central Adriatic Italy. The combination of well-controlled field survey data, assembled in a specific micro-region and via intra-site surveys on some central places, with older data drawn from a wider area, has proven a good toolkit for such experimental analysis. Some preliminary conclusions bring developments in this region of northern *Picenum* fairly neatly in line with noted evolutions documented elsewhere in Italy. This is certainly the case for the observed phenomenon of formation of proto-urban settlements and of the displacement of central places from indigenous locations of visible control to locations better integrated with the new needs of transport and exchange during the later Iron Age and especially the Roman era. Other observations are new and maybe somewhat surprising. This can be said about certain densities of rural settlement in relation to the towns, about the high spatial degree of urbanization in this region and about certain aspects of Romanization. They will no doubt facilitate us and other researchers to better understand developments towards social complexity in *Picenum* during the first millennium BC and to characterize the originality of solutions in settlement dynamics in this part of central Italy.



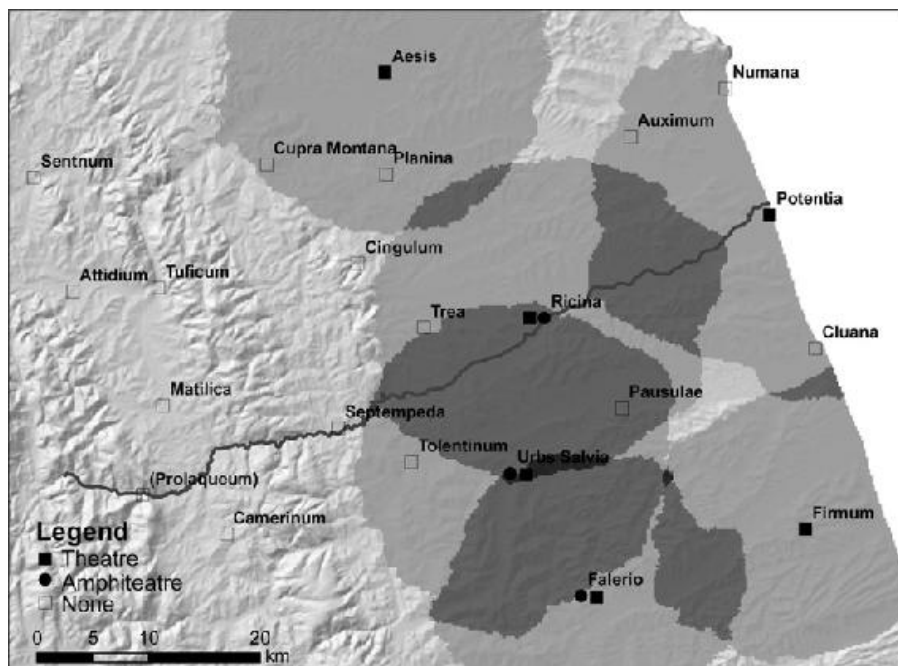


Figure 20.8 Four hour walk isochrones around towns with theatres in the study area.

Notes

- 1 This project, directed by Frank Vermeulen, is mainly financed by Ghent University, Belgian Science Policy (IUAP-actions) and the Fund for Scientific Research Flanders.
- 2 For a discussion on the methodology of the PVS-project and a presentation of some of the main results we refer to: Vermeulen 2006; 2008; Vermeulen *et al.* 2003; 2005; 2006; 2009; Vermeulen and Boullart 2001, Vermeulen and Verhoeven 2004; Verdonck and Vermeulen 2004; Verreyke and Vermeulen 2009; Goethals *et al.* 2009; Boullart 2004; Boullart and Vermeulen 2005.
- 3 Kernel density estimation is a non-parametric way of estimating the probability density function of a random variable.
- 4 During the last two decades several survey projects have studied to good effect many such centralized settlements, as well as their related patterns of rural land-use (cf. the work of Dutch teams in central and southern Italy: Attema 1993; Burgers 1998).
- 5 According to a hierarchic size-based system devised by De Ligt (this volume) we can reconstruct a three-tier division made up of the following components: 2 large towns (*Asculum* and *Hatria*), 6 medium-sized towns (*Ancona*, *Cupra Montana*, *Firmum*, *Ricina*, *Potentia* and *Urbs Salvia*) and 15 small towns (*Auximum*, *Beregra*, *Castrum Novum*, *Castrum Truentum*, *Cingulum*, *Cluana*, *Cupra Maritima*, *Falerio*, *Novana*, *Numana*, *Pausulae*, *Planina*, *Septempeda*, *Tolentinum* and *Trea*)
- 6 Tobler's function estimates time (hours) to cross a raster cell based on slope (degrees) as calculated on a DEM.

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Setting Towns in their Landscape: Forms of Urbanism in the *Ager Faliscus*

R. Opitz and S. Stoddart

Introduction

The *Ager Faliscus* is a region of central Italy enveloped by South Etruria and bounded by a bend of the Tiber northeast of Rome. This was a culturally distinctive urban area in the first millennium BC that was incorporated by Roman imperial expansion through flexible strategies of continuity and dislocation. The Tiber Valley Project (TVP) has covered an area that embraces this region and deliberately bridged the Tiber to look at a coherent arterial catchment. Its work has focused on both rural and urban themes through new surveys and the re-study of the material from the South Etruria Survey. This research has been led by the British School at Rome and involves researchers from 12 British Universities as well as contributions from Italian colleagues (Patterson 2004; Patterson *et al.* 2000). The first phase of the TVP was primarily carried out between 2000 and 2006, and results are now being published. Within this project, the Roman Towns in the Tiber Valley Project (Universities of Southampton and Cambridge) is exploring overall patterns of Roman urbanism through surface survey (Keay and Millett 1998). The Roman Towns project began in 1998 and has now expanded into a wider area, continuing to add surveys of more urban sites. Early in the project, microtopographic survey was listed, alongside fieldwalking and resistivity and magnetometry survey, as an important tool for gathering data on various forms of Roman urbanism (Patterson *et al.* 2000). Microtopographic surveys were conducted, recording detailed contours (on the scale of 10cm) on urban sites together with geophysical surveys (e.g. at *Falerii Novi* and *Forum Novum*) and used in interpreting the town plans (Keay *et al.* 2000; Gaffney *et al.* 2001).

In 2004, as part of the Natural Environment Research Council (NERC) Airborne Research and Survey Facility (ARSF) Mediterranean deployment, a LiDAR survey was commissioned by Simon Stoddart, covering 100km² of the *Ager Faliscus* area of the Tiber Valley and including the urban centres of *Falerii Novi*, *Falerii Veteres* (Civita Castellana) and Nepi (Figure 21.1). The data were principally studied by Rachel Opitz, the main author of this report

and it is on the contextualised results of these data that this paper will concentrate. This survey provided microtopographic data for these urban sites and their surrounding landscape, including areas which could not be covered by the previous total station based surveys because of inaccessibility. The terrain model created from these data was then studied as part of the Mapping the Lower and Middle Tiber Catchment Project (<http://www.arch.cam.ac.uk/lower-tiber/>).

In this paper we review the work done at the towns in the Lower Tiber LiDAR survey area, and the contribution of microtopography to the knowledge of each site. In doing so, we attempt to step back and take a broad look at how urban sites in this area use and fit with their immediately surrounding landscape. The physical topography of each site is used to explore this question, and comparisons are made with a number of proto-urban and medieval urbanized sites in the survey area. This use of topography to study aspects of social urban identity follows the approach taken by Millett (2007). Finally, this broad perspective is used to illustrate the impact of the modern situation on the history of research, and consequently our impression of urban development at each site.

State of the art

The *Ager Faliscus*, for the purposes of this article, focused on the centres of *Falerii Veteres* (Civita Castellana), Nepi and *Falerii Novi*, provides an interesting example of distinctive state formation, imperial incorporation and historical contingency. At the time of first millennium BC state formation, the Etruscan neighbour of *Veii* was the dominant demographic force and it was only in the eighth century BC that both *Falerii Veteres* and Nepi were securely occupied as urban centres. *Veii* may have continued to dominate the area politically during the course of most of the first millennium BC, but the Faliscan area conspicuously showed its independence culturally and linguistically (Ceccarelli and Stoddart 2007). After the fall of *Veii*, traditionally in 396 BC, the Faliscan territory was exposed to the advance of Rome, but its reception was variously treated by the two urban centres of Nepi and *Falerii Veteres*. At Nepi there was continuity of occupation right up to the present day. At *Falerii Veteres*, occupation was interrupted in the Roman period and a new site founded at *Falerii Novi*, although population returned to the site of *Falerii Veteres* in the medieval period.

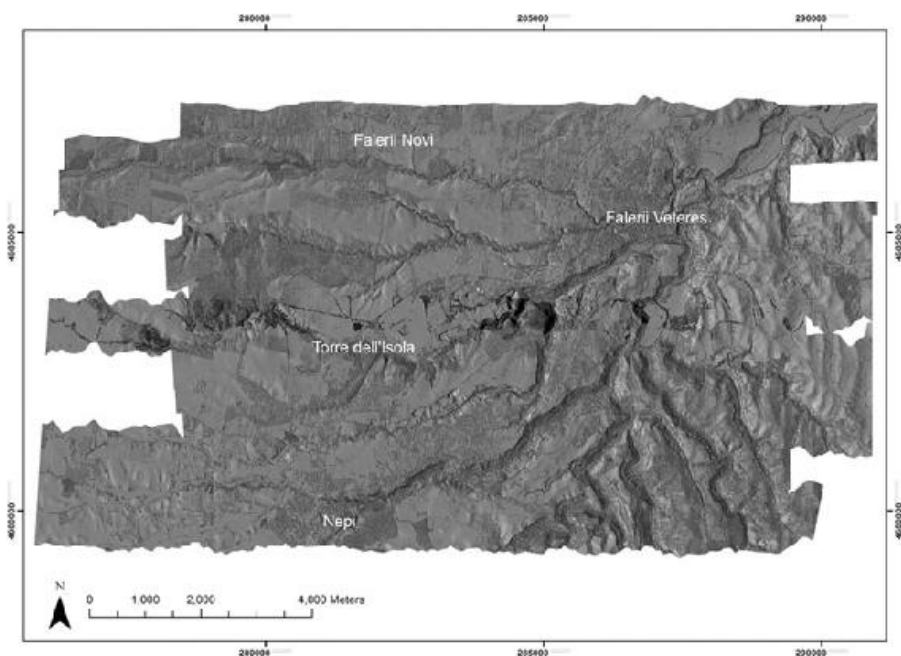


Figure 21.1 General map of study area with urban centres marked. The area between Falerii Veteres (modern Civita Castellana) and Nepi is dominated by deep ravines which segment the tufa plateau.

This differential pattern of urban foundation, development, dislocation and continuity has had implications for study of urban centres in the area. Nepi, an urban centre of substantial continuity, can only be investigated by urban excavation (apart from the suburbs). Civita Castellana, an urban centre of discontinuity, can only be investigated by survey at Vignale, one of two urban plateaux not substantially recoccupied in the medieval period. *Falerii Novi*, only founded after the fall of *Veii*, and largely abandoned at the end of the classical period, provides an optimum area for urban survey.

Tim Potter initiated modern work in the area by his rural survey of half the area, unpublished (Potter n.d.) until the recent re-analysis by the Tiber Valley Project. More recently and initially under his sponsorship, work was undertaken both in the urban centre of Nepi and in the surrounding countryside (Edwards *et al.* 1995; di Gennaro *et al.* 2002; 2008). By researched excavation combined with rescue intervention and conservation by the Soprintendenza Archeologica dell'Etruria Meridionale, a picture of developing urban topography has been reconstructed (monuments, urban population and cemeteries), in conjunction with an expanding and contracting rural population around the urban centre and along the major communication routes. A different research survey led strategy has produced significant but complex results on the plateau of Vignale (Civita Castellana) (Carlucci *et al.* 2007) and staggering results (without excavation) at *Falerii Novi* (Keay *et al.* 2000). The LiDAR data provide a broader context for these foci of research

activity that can be read in conjunction with other survey work in the area.

Methodology

LiDAR (also known as light detection and ranging or airborne laserscanning) is a relatively new survey tool, increasingly used by archaeologists since 2003 (Sittler 2004; Doneus *et al.* 2008; Lasaponara and Masini 2009). It is a technology that produces accurate and dense topographic data, similar to that recorded with a GPS or total station, by scanning the surface of any object with a laser and recording aspects of the returned waveform. LiDAR survey creates a very accurate and detailed model of the terrain in all areas not covered by modern buildings, including those obscured by forest or scrub because some laser pulses will penetrate the vegetation canopy. Data are usually collected for extensive continuous blocks of landscape. The technique is particularly effective in areas outside the modern agricultural landscape where topographic remains are generally well preserved.

The LiDAR survey for the *Ager Faliscus* collected data at a planimetric resolution of 1m, or about 6 pts/m², with two returns recorded per pulse. At the time of collection, a decision was taken to cover a larger area at lower resolution within the available time to satisfy the multiple research interests in the region. Most surveys conducted today collect data at a minimum of 8 pts/m² and four returns per pulse, and full-waveform digitization is recommended for areas with complex vegetation and terrain. Although compared with today's surveys the data are at a relatively coarse resolution, they vastly improved the state of topographic knowledge for the region, where many problems with the IGM data had been noted, and provided new information about a number of archaeological sites, a selection of which we discuss in this paper.

In the *Ager Faliscus*, an important result of the LIDAR survey is the record of the microtopography in the deep narrow ravines which the urban sites universally abut and, as we will show here, incorporate (an idea proposed in Opitz 2009), and areas of the plateau covered in dense scrub. Geophysical and surface ceramic surveys generally cover open areas of the sites and by integrating with LiDAR data the whole urban areas can be studied as complete units. This integrated approach provides some new information and supports new interpretations at these urban centres. In each case, the extent and quality of the complementary data have a large impact on our ability to interpret topographic features.

At *Falerii Novi* the LiDAR survey is interpreted in light of the results of the geophysical survey (Keay *et al.* 2000) which revealed the positions and plans of buildings and the street grid and surface survey which identified a number of tombs cut into the side of the ravine that forms the southern boundary of the town. The good quality of the geophysical survey and extensive survey on the ground at this town support a fairly detailed

interpretation of the local topography (Figure 21.2).

At *Falerii Veteres* the geophysical survey at the Vignale (Carlucci *et al.* 2007) and excavated and surface survey evidence identifying temples and necropoleis (summarised in Moscati 1990), are used together with the microtopographic data to build a picture of an urban centre laid out across disjointed plateaux. In this case the topographic model shows links between various urban and extra-urban parts of this complex centre.

Nepi has proved the most difficult site to characterize, due to extensive modern development over the ancient centre, which precludes extensive geophysical or surface survey. Limited Ground Penetrating Radar survey has been attempted within the urban area. In spite of the difficulties, here the results of surface survey (di Gennaro *et al.* 2002; Rajala 2007) for areas close to the urban centre can be contextualized in the detailed terrain model created by the LiDAR survey.

The use of topographic elements to structure an urbanized space is clearest at a group of medieval sites (some of which have proto-historic phases). Standing remains at these small medieval centres (Torre dell'Isola (also known as Torre Stroppa), Castel d'Ischia, Castel Paterno, Castel Foiano, Castello Agnese) have been recorded both by antiquarian survey (Cozza and Pasqui 1981) and for present day conservation plans. At these sites topographic features, as recorded in the LiDAR model, and built features, as recorded through antiquarian and conservation surveys, are interpreted together. Of these sites the Torre dell'Isola is the best studied, so it is taken as an example for this paper. This site, just north of Nepi, has Final Bronze Age occupation and was then reoccupied in the medieval period.

Results

Within the study area we have a number of sites which might loosely be defined as urban, dating to a range of periods. Some of these sites are relatively short lived, while others have experienced continuous or intermittent occupation up to today. Their builders and occupants faced with broadly similar landscape situations, made different choices about how to use and reshape the topography of the site to structure, together with built elements, their urban space. The topographic features are often well preserved, if masked by dense scrub, on sites without major modern development. At the same time geophysical survey has revealed detailed information about the plans and locations of buildings and surface survey has contributed information on the chronology and extent of the occupied areas. By studying topographic details in light of information from excavation, geophysical and surface survey another aspect of urbanism can be explored.

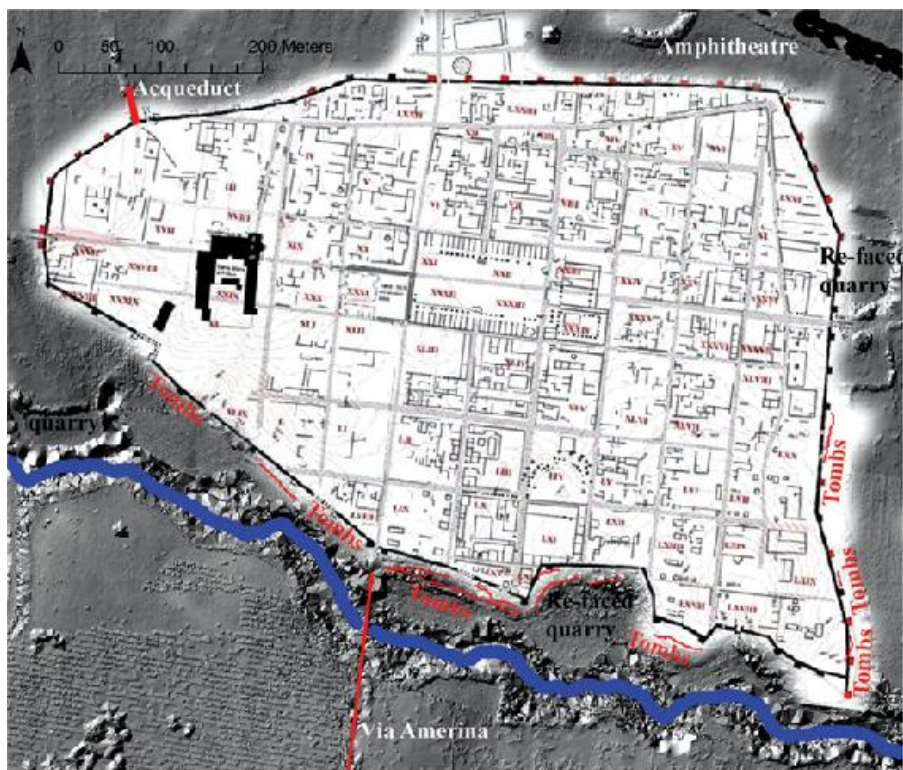


Figure 21.2 Synthetic plan of Falerii Novi showing geophysical and topographic features. Geophysical and topographic survey at Falerii Novi. Interpreted plan of geophysics after Keay et al. 2000.

At *Falerii Novi* the topographic survey reveals features of the urban facade created by smoothed vertical bedrock faces, narrow paths and terracing on the southern edge of the town in the ravine, visible from the *Via Amerina* as it approached the town from Rome. Survey on the ground from antiquarian work to recent studies has recorded a number of tombs cut into the vertical bedrock. The intention seems to have been to rework functional areas during the construction of the site (quarries) into part of the public space in the town. At this Roman town the topographic features seem to be primarily used for display. This tendency is also well illustrated by the area inside and outside the *Porta Puteana*, at the southeast corner of the town (Figure 21.3). Inside the gate a series of steep terraces leads up to the main level of the town, occupied by the street grid and buildings. Outside the gate the bedrock has been carved back in a shallow trapezoid framing the gate (Figure 21.2). Further east a tall narrow spur of bedrock is left standing between the smoothed and cut-back

southern face of the town and the deep narrow passage carved along its east side. This spur is topped by one of the town's towers, emphasizing its height. Given the effort expended in cutting back the bedrock surrounding the gate to make it roughly straight and evenly matching the walls, and the equal effort to create a deep cutting just to its east, it seems that leaving the spur was an intentional decision in the design of the town's facade.

At *Falerii Veteres* temples located in ravines and necropoleis located on cliff edges may be connected by narrow rock cut paths sunning along the sides of the ravines. Preserved sections of these paths, now heavily eroded, can be seen in the LiDAR model. Geophysical survey on the Vignale (Keay *et al.* 2007) revealed the start of one such rock-cut road leading away from the temple toward the edge of the ravine.

At *Falerii Veteres*, the topographic survey reveals paths linking various areas of the site, including temples and necropoleis (Figure 21.4). The number of paths suggests the temples and necropoleis are part of the urban fabric, closely linked to the habitation areas, and not extra-urban sites loosely connected to the urban site. Further, the topographic model provides another perspective on some of the necropoleis. The tombs themselves were well documented by Antiquarian survey (Cozza and Pasqui 1981) and later surveys. The practice of locating necropoleis in visible, but hard to reach, locations has been noted many times for the protohistoric period in this region (Belcher *et al.* 1999). The LiDAR model illustrates that tombs were not simply inserted into the bedrock and paths cut for access. The necropoleis were extensively terraced and reshaped to allow a larger number of tombs in a relatively small area (Figure 21.5).



Figure 21.3 South face at Falerii Novi. Terraces near the Porta Puteana on the south face of Falerii Novi are seen in profile. Profile location marked in red on the plan.

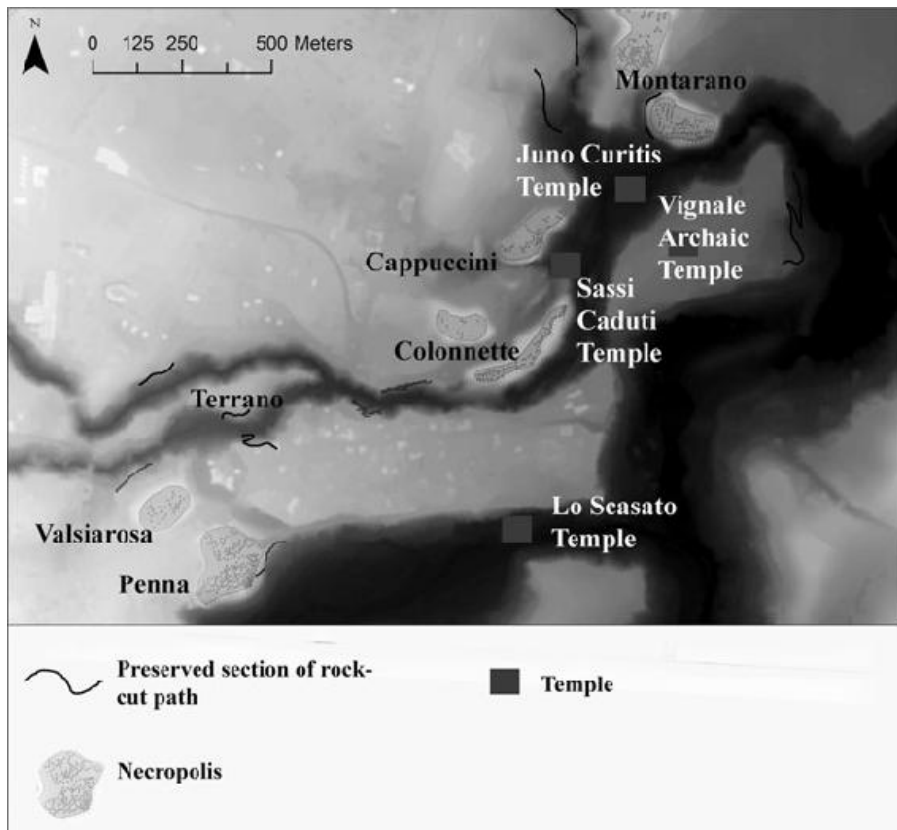


Figure 21.4 Plan of Falerii Veteres showing locations of temples and linking rock cut paths.

At Nepi, the later development masks much of the ancient centre (Edwards *et al.* 1995; di Gennaro *et al.* 2002; 2008). There are several locations in the ravines near the site where the bedrock has intentionally been smoothed to create flat vertical surfaces, likely marking rock-cut roads. These suggest that like other sites in the area, Nepi, while located on the plateau, made active use of the surrounding ravines. The cliff faces that form the upper parts of the ravines are certainly in use as necropoleis, and the paths linking the settlement to the necropolis may well have been primarily in the ravines, as at *Falerii Veteres*.

At both *Falerii Novi* and *Falerii Veteres*, the main preserved topographic features are on the edges of the sites or provide links between areas, and the purpose of many features seems to be more aesthetic than practical. On the other hand, at medieval centres in the Lower Tiber area topographic features appear more frequently in the interior of the sites and seem primarily to enlarge the available space for habitation.

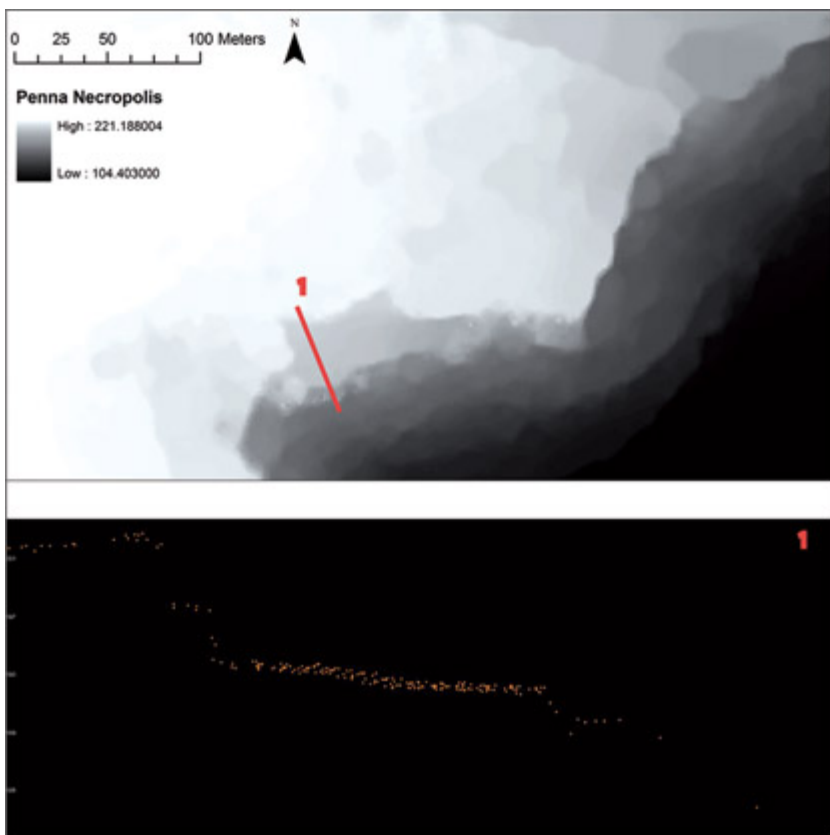


Figure 21.5 Necropolis at Falerii Veteres Terracing can be seen in profile at the Penna Necropolis at Falerii Veteres.

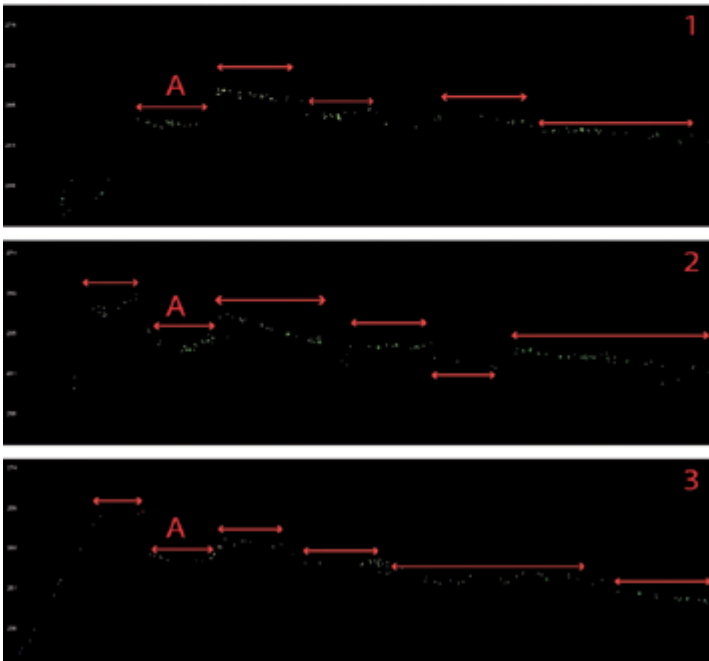
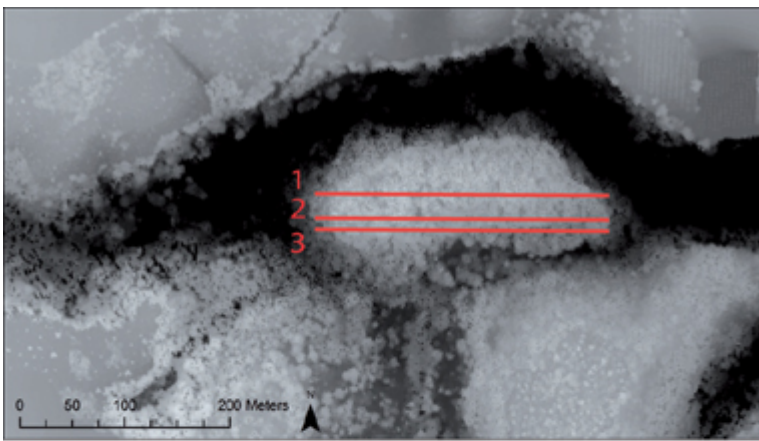


Figure 21.6 Large terraces at Torre dell'Isola. Three 230m long profiles, marked in red on the plan, across the Torre dell'Isola show the complex system of cuttings and terraces on the plateau. This extensive use of internal terracing is typical of medieval centres in this area. A: The main north–south cutting across the site. Individual cuts and terraces are indicated by arrows.

The Torre dell'Isola is typical of small medieval centres in this area in its extensive use of topographic features and terracing in the interior of the site (Figure 21.6). The Torre dell'Isola contains elements from both its proto-historic and medieval occupations standing on the surface, and illustrates some of the difficulties in dating topographic elements of multi-period sites. Topographic features can be assigned relative dates if they intersect other features with more secure chronological situations. For example, at the Torre dell'Isola broad cuttings around the edge of the eastern part of the plateau

create space for tombs, many of which were noted through surface survey, and the terracing on the eastern part of the plateau is cut by a number of cavities interpreted as protohistoric tombs. This suggests that the terraces themselves date to the earlier occupation of the plateau.

In contrast to the cuttings around the edge of the site, which seem likely to date to the earlier occupation of the plateau, cuttings and terraces on the interior may relate to the medieval occupation. On the eastern part of the plateau three large terraces can be seen. Within them the topographic survey reveals a number of flattened slight depressions, which may represent the locations of buildings or other structures, now destroyed. A deep cutting across the narrow axis of the plateau has several large rooms cut into either side. The function of the rooms cut into its sides is unclear. Broad ditches or cuttings are typical of medieval sites in this region so it is tempting to ascribe this cutting to the later occupation on those grounds. This is supported by general division of the built medieval remains by this cutting, with the main concentration of stone built structures to the west of the cutting, including the site's main tower, and only a single structure (the remains of a church) to the east of the cut.

Conclusions

While survey can provide new perspectives on urban centres, it should be noted that the possibilities for this approach are very much restricted by the modern situation. More generally, this overview of the urban sites of the *Ager Faliscus* emphasizes the extent to which modern development has a major impact on the type and amount of information available. For example, it is far more difficult to interpret the topography of Nepi, where modern development has made extensive geophysical or surface survey difficult, than to interpret the better known *Falerii Novi* or even the much smaller scale, but better preserved situation at the Torre dell'Isola.

In spite of any challenges posed by modern development, topographic models created through survey can contribute new information and encourage the pursuit of new perspectives in the study of urban sites. In particular the study of the data emphasizes the intentional reshaping of the physical terrain in the organization of urban topography. A review of the use of topographic features at urban sites in the *Ager Faliscus* suggests that the extent and motivations of this practice varied widely, even among sites where the geology and general topographic location (on the top of plateaus in locations adjacent to ravines) is fairly uniform. In this, LiDAR contributes another element to the ongoing studies of urbanism in the Tiber Valley.

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Urban Landscape Surveys: A View from the End

N. Christie

This volume has, to me, revealed an exciting vitality to the study of what might be termed a ‘discarded’ urban past. I say ‘discarded’ in the sense that the majority of the sites explored in this publication and explored by a mass of skilled workers on the ground are ‘lost’ or, in other words, ‘failed’ sites. The label can seem applicable when such sites are visited – often the fragments of buildings are scattered and discarded in their landscape, sometimes near their original setting, but often shifted, and, in other cases, reused in medieval to modern contexts, whether houses, field walls or terracing. But what all these papers do is to relocate these discards, to trace their settings, and to breathe life into these lost towns.

However, a key fact that the various contributors have shown, is that all sites are different, dependent on a variety of factors specific to the locale: natural setting and geomorphological changes; scale of the site and its depth of monumentality and population; post-urban population presences and needs; medieval to modern efforts to rob or reclaim the ground; earlier modern archaeological and other intrusions. Accordingly, some sites are far more visible than others; some are more accessible than others; some have landmarks which guide readings as to what is missing; and some have been more damaged than others. But, most importantly, each site offers great potential and surveys detailed here provide on one level the ‘homework’ for further and more intrusive study and on the other level provide the foundations for framing the management and protection of these crucial sites. These former towns are, after all, to be seen as open-air archaeological laboratories or even perhaps as operating theatres. Using the latter analogy, the land and monuments form the body of the archaeological urban patient, scrutinies are being made of the patient’s condition, and methods are employed to chart the status of this patient, to diagnose needs and to point to ways to probe and gain a better understanding of what can be learnt and what questions can be asked. What is valuable here is that the various projects can see what has worked, what factors have hindered reading of the hidden features, and can share ideas in ways forward, pooling ideas regarding research questions, both archaeological and historical.

Italy and beyond

By having a strong grouping of Italy-based projects reported and discussed in this volume, arguably this means that we receive a clearer image of how we might frame questions regarding ancient Italian urbanism and archaeologies of urbanism here. Indeed, what is evident from examinations and discussions of the emergent plans and extents of centres such as *Amiternum*, *Aquinum*, *Teanum* and *Suasa* is the variety of urban expression – in terms of their planning, the ordering of public space, monumentalisation, linkage with and exploitation of the natural topography, and relationships with pre-Roman settlement and religious foci. At Teano, for example, while the current geophysical surveys suggest a complex sequence of Roman-period built space, streets and planning, which included and respected the older Italic sanctuary at Loreto, a problem lies in the lack of archaeological access to the Hellenistic-period settlement focus on the acropolis, the seat also of the medieval and modern successor to the Roman town; in this instance, the full picture of the urban form and the roles of its constituent parts necessarily remain incomplete. Did the acropolis retain a role? If so, did the new town plan follow a less artificial course? Does the respecting of the Loreto sanctuary tell us of the character of the urban population, with religion core to its role? Was public space determined by these pre-existing centres (little of the traditional array of public monuments bar a theatre and amphitheatre are evident in the new survey work)? And what happened when the sanctuary declined? For *Amiternum*, the busy clustering of public structures and the seemingly low level of private spaces or buildings of local well-to-do may denote a centre of administration and religion as opposed to a bustling urban community; the town was a stretched one, with the *via Caecilia* as the spine, but with minimal branches from or parallel to this. Here questions centre on the levels of attraction of the town to local farmers and landowners, with wealth evident at least in the investment in public structures (again the theatre and amphitheatre stand out) and in the necropoleis. But was this a partly absentee elite participation, and might villas in the landscape reflect this? Indeed, it is evident that once the wider landscape context is drawn into discussion – as underway for *Falerii Novi* and its predecessor and successor *Falerii Veteres* (Civita Castellana) – these Roman towns, continuous or lost, come into a different light. This is brought out especially by Simon Keay (2010) in his paper comparing earlier urbanisation processes and contexts in central Italy and southern Spain, in what might be seen as a companion volume – *Changing Landscapes. The Impact of Roman Towns in the Western Mediterranean* (Corsi and Vermeulen 2010), where an emphasis on Romanisation gives strong focus to the interpretations of the emerging archaeology. These towns did not stand in isolation, but drew on existing populations and settlements and their economies; they reacted to local as well as central needs; they performed functions and linked with other centres. At the same time, each urban trajectory differed.

While Italy has been the principal focus to this present publication – in part a reflection of course of where the conference sessions were held but also of where the techniques of urban landscape archaeology are currently being most applied – it is valuable to stress how in Italy these projects are suitably scattered. Unlike field survey or landscape archaeology projects of the last few decades which, arguably, have had a strongly central Italian emphasis (with still some persistence of this trend, notably in the Tiber Valley Project, which has been a major stimulus to urban landscape archaeology – see Patterson 2004), what is clear is that the range of projects active or undertaken has gained a fuller spread in the peninsula and duly reflect where these abandoned or lost sites are located – with the south a particular ‘hotbed’ for these (Arthur 2004; see also Volpe and Turchiano 2005). There are gaps of course – Sicily misses out here as does northwest Italy – but what is anticipated is that these published results and their flags for successful methodologies will generate a wider momentum.

Italy by no means has a monopoly on abandoned and ‘open’ urban sites and this momentum will gather elsewhere. While only one paper in this volume discusses a Portuguese project, the Iberian peninsula is heavy with failed towns which, in a high number of cases, have long seen archaeological – i.e. excavation – scrutiny. What will be invaluable is to see a more systematic employment of the other techniques identified in this publication to sites like *Tiermes*, *Conimbriga* and others. Most have also seen projects of archive exploration, re-analysis of finds, old reports, museum data, air photographic analysis, etc., but starting to employ other techniques and, especially recording systems, may guide usefully in terms of management of these sites and strategic planning for future excavation and conservation. In fact, *Changing Landscapes* (Corsi and Vermeulen 2010) takes a strongly Iberian slant: alongside reports centred on excavated data (e.g. Reis Martens and Abreu de Carvalho (2010) on Braga, and Correia and De Man (2010) on *Conimbriga*), it is valuable to observe the strongly geoarchaeological approach being pursued at *Ammiaia* in central Lusitania province (Vermeulen and Taelman 2010, see also Corsi, this volume), with a notable target to explore the abandoned town’s catchment zone, in order to understand local resources and modes and levels of exploitation (including of resources such as gold and rock crystal); meanwhile, other papers put towns into their rural context by mapping in particular extant traces of centuriation, relationships to roads, and related rural settlement trends (e.g. for Tarragona, by Palet Martínez *et al.* 2010 and Prevosti *et al.* 2010). A benefit that these projects show is that clearly town archaeologies in Spain and Portugal are starting to ‘talk’ far more to rural archaeologies and to stimulate fuller dialogue on connections and communications between urban centres and hinterlands. But it is important to push such dialogue elsewhere and in the Mediterranean context North Africa remains sluggish in this respect, despite a good number of important rural surveys (Leone and Mattingley 2004). City surveys still

remain underdeveloped, although a notable exception to this is at the port-town of *Leptiminus*, where a major interdisciplinary project initiated in 1990, and forming the first urban landscape survey for North Africa, has produced significant tie-ins to economic changes in the province and landscape over time (Stone *et al.* 2011).

New work in established venues

It is important to identify also that the methodologies employed and synthesised in this *Urban Landscape Survey* volume do not and should not relate solely to abandoned and buried sites. There are a number of substantial sites in the eastern Mediterranean where preservation of monuments has been strong and these have either long remained visible or been brought properly to light through excavation. Some major urban centres have been the focus of extended archaeological ‘Missions’ by French, German, Austrian, Italian, US and other teams – such as the Italian campaigns at Gortina on Crete, French and Canadian missions at *Xanthos*, and US/New York programmes at *Aphrodisias* – and it is perhaps too easy to rely on the standing remains and work from these outward, and to argue that much of the site plans is legible already. However, as papers by Groh (on *Ephesus*), Scardozzi (on *Hierapolis*) and Martens *et al.* (on *Sagalassos*) ably demonstrate, landscape archaeological approaches can play crucial roles in expanding known images. This is particularly borne out at *Ephesus*, where, even after a century of excavation by Austrian teams, the city’s private and suburban faces still remain poorly understood; however, the 2000–2006 programme of geophysical and surface surveys have filled some of this gap, providing a first mapping of space beyond and even between the public spheres (these very much the long favoured focus of archaeological investigation). Furthermore, the application of specific geophysical techniques in an excavated but built context like *Pompeii* (see the paper by Camardo *et al.*) shows how other routes might be fruitfully employed to enhance knowledge even of the innards of a ‘known entity’.

Determining ‘ends’

For the majority of cases discussed in this volume, these largely buried and abandoned sites denote urban creations that fell away in the late classical period especially, to be deprived of their populations and their economic or political *raison d’être*. They were discarded – sometimes consciously and strategically – from the wider assemblage of urban centres that continued, that retained their political, religious or economic roles, and that generally exist today in recognition of the validity and success of their foundation and function. Their very loss as towns therefore makes these places of significance. My own focus of research interest is in late Roman to early

medieval settlement sequences, core to which is interrogating why some sites failed while others persisted (see also Christie and Augenti forthcoming). In the past, bland statements on the end of Roman rule and the failure of towns reflected a ready expectation of urban and Roman cultural loss; an expectation was also for losses through warfare, through sacks by enemies, or by desertion through inadequate defences in a period of growing and lasting insecurity. The real picture is of course otherwise, since few towns were destroyed in warfare and natural disasters such as earthquakes rarely provoked permanent urban change and decay; however, archaeology does show, for the western provinces especially, early decline of specific Roman attributes, such as baths complexes and theatres, meaning that some centres were at a low ebb when the insecurities of the fifth century especially hit. More pertinent questions are thus: Was urban survival into the early Middle Ages and beyond down as much to military strength – garrison, walls, strategic value to state/kingdom/power – as to a retention of population? Did walls and military strength give greater resilience to a population? Did such attract others from the landscape and from more exposed sites? Or must we look, in Late Antiquity, to the input of the Church, with bishops providing a human focus to settlement resilience? Did urban decay therefore relate to a weak military status, a failure to retain population, a lost institutional or ‘central’ role, and a lack of religious ‘glue’? Or did wider politico-economic changes prompt decay? As Rome’s western provinces fell away and this Empire shrank to its core, as elite roles, moneys and display mechanisms disappeared, and as the wider economy faltered, did the basic institutional framework which had brought many towns into being also break down?

The numerous cases of ‘lost’ towns explored in this volume provide, accordingly, scope to tackle many of these questions, since these sites, even if venues of periodic robbing, do not have the overburden and intrusions of centuries of continuous use and rebuild. Systematic excavation programmes, building on the mapping work already achieved, could provide hugely important insights into changing urban characters across the later Roman and late antique period, could help to observe material and economic evolutions and devolutions, and could chart when, for example, pagan religious edifices fell out of use, and levels of Christian input began. To a good degree, ‘lost’ towns such as *Gortina*, *Ephesus* and *Aphrodisias*, with their high quality built survivals, have already seen interrogation on these issues for the East Empire (see, for example, on the theme of Christianisation and Church roles, papers in Farioli Campanati *et al.* 2009), but the trajectories there will differ strongly from those in Italy and the West. The potential of these sites is thus high – but with the warning note that their losses as towns may help less in explaining ends and will chiefly help in charting the modes and rates of decline. Their potential is even higher of course for tackling urban origins, heydays, households, public organisation, design, and basic living. We noted above the Austrian missions at *Ephesus* having already taken a century of work. Each of

the sites discussed in this publication could equally merit many decades of detailed sub-surface exploration.

Summary

What stand out to me from the delivered papers and this resultant publication are these aspects: first an elevated awareness of a rich buried heritage in the form of often largely abandoned townscapes; second, the growing range and complexity of techniques which are now being regularly and consistently applied across many areas of the Mediterranean and beyond, and the potential for further techniques to evolve; third, the questions that are being asked before, during and after the application of these techniques and the adaptation of questions and techniques as projects evolve; fourth, the potential mass of data gathered and the complexity of recording and working with these, with implications for storage, personnel, publication methods and, as importantly, costs – crucial considerations in a climate of straitened economies across Europe (and with high costs implications if more intrusive fieldwork ensues); fifth, the potential for extended and more developed debates on urbanism, landscape evolution, hinterlands, and urban loss; and, finally, there is the issue of heritage and management, since in various of the papers there is reference to recent robbing of sites for materials, the encroachment of modern communities, damage through ploughing or other agricultural works, land ownership issues, and even threats from nature – e.g. erosion, colluviation, etc. These detailed, systematic and highly informative surveys should make landowners, local authorities, regional bodies, museums, etc. more aware and better informed of the value of this buried urban heritage and the need to preserve and study it. Much work has been done, and many valuable results generated; but much more fascinating, challenging and rewarding work awaits.

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A proposito di *Urban Landscape Survey*: qualche nota di método

F. Coarelli

La lettura di questo volume¹ ha suscitato in chi scrive una serie di considerazioni e di spunti, molti dei quali, in qualche modo già presenti *in nuce*, hanno ora assunto forma più chiara e organica, proprio in relazione alla rilevanza dei lavori in esso contenuti, che raccolgono una serie impressionante di nuovi documenti.

La prima constatazione è infatti l'enorme progresso delle conoscenze determinato dall'uso, ormai sistematico, dei nuovi metodi di 'field survey', estesi in questo caso ai centri urbani. Scoperte come quelle relative a *Falerii Novi*, che hanno posto a disposizione degli studiosi, per la prima volta in Italia, l'intera pianta di un centro antico, sono infatti da considerarsi epocali.

Si tratta comunque finora, almeno a mio parere, di progressi sostanzialmente *quantitativi*, che per divenire *qualitativi* a tutti gli effetti richiederanno lunghe e complesse operazioni di analisi e di interpretazione. Come giustamente riconosce uno degli autori (Burgers: p. 19), 'detecting such a shift is one thing, interpretation is another': in altri termini, l'incremento esponenziale dei dati non implica da solo (almeno in prima battuta) una trasformazione radicale dei sistemi interpretativi, una 'rivoluzione' di questi ultimi. Nessuno di noi, penso, è così ingenuo da confondere tecnologia con scienza.

Per quanto mi riguarda, ritengo che ogni vero progresso scientifico abbia origine dal cambiamento delle problematiche, questo a sua volta determinato da esigenze attuali, contemporanee. Come diceva un vecchio filologo italiano, Giorgio Pasquali, non esistono discipline, esistono solo problemi da risolvere. E i problemi che ci interessano non sono più (o meglio, non sono soltanto) quelli che si ponevano i nostri padri e i nostri nonni.

Condivido dunque l'entusiasmo per i nuovi metodi (tecnologici) e per i nuovi risultati: ma sento anche, con forza, l'esigenza di una pausa di riflessione.

Per natura e per scelta, non sono molto interessato al conflitto (inteso in senso qualitativo, gerarchico) tra ciò che sarebbe 'tradizionale' e ciò che sarebbe 'attuale': l'opposizione che conta, a mio avviso, è quella tra metodi

‘utili’, che funzionano, e quelli che ‘non funzionano’: naturalmente in senso relativo. Da questo punto di vista, l’elemento determinante è il ‘problema da risolvere’: se questo è di carattere ideologico (ad esempio, filosofico o artistico), i documenti letterari saranno indispensabili, quelli archeologici per lo più inservibili, e comunque marginali. E l’ideologia resta un argomento fondamentale per lo studio della società antica, se non altro per capire cosa gli antichi pensavano di se stessi. Viceversa, se si tratta di un problema di cultura materiale. Ancora una volta, è la problematica che determina l’utilità, o l’inutilità, di questa o quella disciplina, indipendentemente dal fatto che si tratti di disciplina ‘tradizionale’ o ‘moderna’.

Ciò non è sempre chiaro a tutti, e può condurre ad espressioni involontariamente paradossali, quale quella che appare in un contributo del volume (Opitz e Stoddard: p. 2–4), che suona ‘after the fall of *Veii*, traditionally in 396’: dove, più che un dubbio sulla data effettiva dell’evento, difficile da contestare, sembra di scorgere il rifiuto programmatico di ogni dato che provenga dalla tradizione letteraria (anche se in questo caso pienamente confermato dall’archeologia).

Non è certo casuale se una posizione equilibrata emerge più facilmente quando ci si proponga di allargare il quadro a interi settori regionali: è questo il caso del contributo di L. de Ligt, dal quale è opportuno prendere le mosse, e con il quale concordiamo in pieno quando afferma (de Ligt: ch. 18): ‘It seems possible to conclude that urban survey has become one of the most flourishing sub-disciplines in Italian archaeology and that spectacular results have been achieved. However, so far few attempts have been made to use these results to build up or to update reconstructions of urban systems at a regional scale’. In quest’ultimo tipo di ricerca: ‘we must obviously combine this type of evidence with the results of older and more recent work which was done in the topographical tradition’.

Tuttavia, la tendenza più diffusa non sembra questa: prevale anzi una visione polarizzata, ‘agonistica’ della ricerca, in cui l’aggettivo ‘tradizionale’ viene inteso in accezione totalmente negativa, a confronto con le ‘magnifiche sorti e progressive’ (Leopardi) delle nuove tecnologie: dove, invariabilmente, il duello deve concludersi con la vittoria totale di queste ultime. Ora, si tratta a mio avviso di una posizione metodologica del tutto improduttiva: che il rapporto tra discipline debba essere, con reciproco vantaggio, collaborativo e non conflittuale emerge più volte dal lavoro di De Ligt: ad esempio, quando, in opposizione alla nota opera di Susan Alcock (1993), si afferma (de Ligt: p. 138): ‘This finding (*Thespiae*) seems to support the traditional view that the Hellenistic period marked the beginning of a long phase of demographic contraction in at least some parts of the Greek mainland’: musica per le orecchie di chi ha scritto di recente cose del tutto simili (Coarelli 2009). Analoghe ed egualmente condivisibili critiche sono rivolte alle note conclusive di Burgers (p. 19), dove l’incremento di sepolture del primo ellenismo nell’area salentina ‘is not so much an indicator of demographic

change but rather should be read in the light of funerary practices and related social structures'. Ancora una volta, non posso non concordare con De Ligt quando afferma (p. 189) che: 'with so many of the older fortified settlements declining and in the absence of strong population growth in the countryside ... it remains difficult to avoid the conclusion that the population of southern Apulia declined in late-republican and early imperial times'. Per indicare quanto ciò sia conforme ai dati delle fonti letterarie, basterà qui ricordare il ciceroniano 'Magna Graecia, quae nunc deleta est', che nessun sofisma potrebbe cancellare. Va ricordata inoltre la totale cessazione della monetazione argentea nelle città della Magna Grecia a partire dalla metà del III secolo a.C. Che contemporaneamente si assista a un notevole incremento del territorio di Brindisi non è certo un caso, ma precisamente una conseguenza della conquista romana, caratterizzata dall'insediamento di nuove colonie, dalla trasformazione della rete viaria e, in definitiva, dalla destrutturazione dell'assetto precedente, preromano. In altri termini, per usare un termine oggi troppo svalutato, ma insostituibile, dall'impatto della romanizzazione.

In questo senso, in merito ad alcuni contributi, dobbiamo notare alcune mende, che dipendono da una tendenza diffusa in tutti questi studi: la mancata considerazione del dibattito sugli stessi temi, sviluppato da decenni (in particolare in Italia) non solo nell'ambito della ricerca archeologica, ma soprattutto della ricerca storica e istituzionale, dibattito dal quale si sarebbero potuti trarre molti spunti e informazioni. Ciò dipende, in ultima istanza, proprio dall'atteggiamento 'agonistico' già segnalato, che determina una sostanziale sottovalutazione delle discipline considerate 'tradizionali', e quindi superate.

Qualche esempio mi sembra opportuno, e per questo dobbiamo partire da alcune significative lacune bibliografiche: ad esempio, la mancata citazione dei fondamentali lavori di Forni relativi al rapporto tra la capienza dei teatri e degli anfiteatri e la popolazione, o degli atti del convegno sulla valle del Tevere (avvenuto alla British School di Roma nel 2004!), *Mercator placidissimus* (Patterson e Coarelli 2008).

Analoghe considerazioni si possono fare nel caso della ricerca sulle città vesuviane, dove, a proposito dell'area meridionale di Pompei, dopo aver proposto un'improbabile datazione di fondazioni in blocchi di 'pappamonte', ovviamente archaiche, al IV secolo a.C., ci si domanda la ragione dell-'unexplained' abbandono della zona per circa un secolo: se si fosse tenuto conto delle estesissime ricerche effettuate, nel corso del progetto 'regio VI', dalle Università di Perugia, Trieste, Venezia e Napoli Orientale si sarebbe scoperto che tale abbandono (riferibile in realtà al periodo compreso tra la fine del V e la fine del IV secolo a.C.) si riscontra in gran parte della città, ed è quasi certamente collegabile con l'occupazione sannitica di Pompei.

Il discorso diviene più ampio quando ci si deve confrontare con la nozione stessa di città, inaggrirabile quando si parli di 'urban landscape'. La lettura del

volume fa emergere una tendenza – forse inconscia – a considerare la città come un presupposto scontato, come essa in effetti non è. Ciò dipende probabilmente dall’abitudine, diffusa tra gli archeologi ‘di terreno’, a collocarsi all’interno non solo della ‘longue durée’ (ciò che è inevitabile) ma anche a scivolare verso una radicale sottovalutazione del cambiamento e delle crisi, e quindi in definitiva della storia.

Non è immaginabile una ‘realtà archeologica’ distinta da una ‘realtà storica’ di tipo tradizionale. Anche la città è una fatto storicamente determinato, che si manifesta solo in particolari condizioni strutturali, in mancanza delle quali essa non può esistere. Nel caso dell’Italia antica, ad esempio, è possibile riscontrare di frequente la scomparsa di centri urbani. Il fatto è particolarmente rilevante nel caso della Magna Grecia di età romana: e basterà qui citare il caso paradigmatico di Metaponto; ma soprattutto, si deve constatare l’assenza della città nelle regioni appenniniche della penisola, dove il predominio di situazioni sostanzialmente non urbane, vicane, che tende a prolungarsi anche dopo la romanizzazione, non è più da dimostrare. Questa particolare struttura per *vici* è stata più volte presa in esame dal dibattito storiografico sviluppatosi in Italia da cinquant’anni a questa parte, e ha trovato recentemente una sistemazione teorica in opere come quella di Capogrossi Colognesi (2002). Tra i convegni dedicati al tema, va menzionato almeno quello svoltosi a Rieti nella primavera del 2010, ancora inedito.

L’aver tenuto conto di tutto questo ricco e complesso dibattito, avrebbe arricchito alcuni articoli del volume, e avrebbe potuto evitare almeno una certa ‘ingenuità’ metodologica, quando non veri e propri errori.

Un esempio di tale ingenuità traspare dal lavoro, peraltro importantissimo, di M. Heinzelmann e D. Jordan (p. 31) su *Amiternum*. Vi si legge che il centro dimostrerebbe ‘a strangely contradictory picture of a strong urban infrastructure, with a disproportionately large number of public buildings, and a correspondingly small number of residential buildings’. La conclusione è che ‘the results of the project change the current picture of Roman *Amiternum* considerably. It is possible that *Amiternum* was not a well-developed town of medium size, as was previously assumed, but was rather a partially developed urban centre providing administrative functions and other services for a larger catchment area’: conclusione del tutto condivisibile, ma che sfonda una porta aperta, poiché da tempo essa è emersa negli studi precedenti, ciò che rende difficile capire dove gli autori abbiano trovato una ‘current picture’ di *Amiternum* come città pienamente sviluppata: tutti gli studi recenti sulla città, almeno in Italia, hanno sempre riconosciuto che si trattava di un centro meramente amministrativo e di rappresentanza, chiara conseguenza della romanizzazione, mentre l’habitat aveva sempre conservato il suo originario carattere vicano. Il municipio, che sostituisce con molto ritardo la precedente prefettura, è quindi solo una superfetazione formale, destinata a dissolversi, con il ritorno alla precedente situazione, non appena la pressione politica di Roma viene a cessare. Ciò risultava perfettamente chiaro già prima delle

indagini recenti: basterebbe considerare, ad esempio, i luoghi di provenienza dei numerosi sepolcri monumentali di età tardo-repubblicana e augustea, appartenenti all'aristocrazia locale, scoperti invariabilmente nelle zone occupate dai *vici* preromani (corrispondenti ai villaggi moderni): segno evidente che la popolazione di *Amiternum* (compresi i ceti egemoni) continuava ad abitare nelle sedi originarie anche dopo la creazione del municipio.

Sarebbe del resto facile menzionare i numerosi casi analoghi, presenti in tutta l'area sabellica, da *Forum Novum* a *Iuvanum*, che attestano la persistenza universalmente diffusa del modello vicano, su cui l'urbanizzazione municipale incide solo superficialmente, con strutture limitate all'ambito pubblico.

A questo proposito, de Ligt parla giustamente di 'città in senso meramente giuridico': tuttavia anche questo autore, nel suo tentativo di ricostruzione della demografia antica, trascura di utilizzare documenti fondamentali, anche se di epoca più antica, come il calcolo polibiano delle leve militari che la lega romano-italica poteva mettere in campo subito prima della guerra annibalica. Questo documento è stato invece sfruttato appieno da Adriano La Regina, in un importante contributo, letto in un convegno del 1969.

In tutti i contributi si nota un'insufficiente considerazione degli aspetti istituzionali relativi all'urbanizzazione dell'Italia: ad esempio, l'esame delle singole città non può prescindere dalla considerazione delle loro caratteristiche politicoamministrative: se si tratti cioè di colonie, di municipi o di centri federati. Inoltre, esistono casi, come quello di Capua (la seconda città per grandezza dell'Italia antica) che, per un periodo prolungato (dalla guerra annibalica a Cesare), fu del tutto priva di strutture politico-amministrative: per la mentalità antica, si trattava quindi di una 'non-città', di un semplice rifugio di *aratores*, come viene definita. In definitiva, l'inverso dei municipi dell'Italia appenninica, meri centri amministrativi, quasi 'città senza abitanti', mentre per Capua si dovrebbe coniare il termine simmetrico di 'abitato senza istituzioni', corrispondente per l'appunto a una 'non-città'.

A qualche altra considerazione induce l'articolo di F. Vermeulen e D. Mlekuz sul Piceno. Anche in questo caso, sono ammirevoli i risultati di un'esplorazione sistematica, estesa a gran parte del territorio, che appare fondamentale per la conoscenza di quest'area, che si sarebbe potuta avvantaggiare meglio della ricerca precedente. Ad esempio, la condivisa affermazione (Vermeulen e Mlekuz: p. 217) che: 'Although the expansion of Roman roads since 220 BC in this area first followed military developments, they soon became a new and privileged means of communication between different areas of the peninsula, radically transforming the existing market system and generating new routes to serve Roman interests. The nodes of this network were formed by the new Roman and Latin colonies and both roads and cities played a major role in the emergence of a new political identity, contrasting with the character of indigenous inter-territorial connections'

avrebbe potuto essere inquadrata nelle considerazioni emerse nel colloquio dedicato anni fa dalla rivista 'Dialoghi di Archeologia' al fenomeno della colonizzazione romana (*Dialoghi d'Archeologia* 1988). Considerazioni a cui chi scrive non può che aderire entusiasticamente, dal momento che da tempo egli ha espresso concetti del tutto analoghi, ad esempio in un articolo su 'colonizzazione e viabilità' (Coarelli 1988).

Anche altre affermazioni appaiono del tutto condivisibili, come quando si riconosce (Vermeulen e Mlekuz: p. 211), in opposizione a molte critiche recenti del concetto di romanizzazione, che 'in this area of Italy only the full incorporation into the Roman world after the mid century conquest triggered the appearance of real cities'.

Con questa presa di posizione sembra però contrastare la tesi (*ibid.*, p. 219) che la continuità delle feste collettive nei santuari preromani 'might represent a resistance to the process of Romanisation and a way to negotiate their specific Picene or Umbrian identity, even as Roman citizens'. Sappiamo infatti che si trattava per lo più della rivitalizzazione di antichi santuari etnici, dovuta all'intervento diretto di Augusto (di una forma di 'nostalgia augustea', per dirla con Torelli), come nel caso dell'etrusco *Fanum Voltumnae* e del santuario etnico degli Umbri, illustrato dal notissimo rescritto costantiniano di *Hispellum* (Coarelli 2001). Queste note non esprimono in alcun modo un giudizio negativo su un'opera complessiva di grande rilievo, destinata a costituire oggi (e certamente sempre più in futuro) un contributo fondamentale per i nostri studi: esse vanno intese come un contributo critico mirato all'apertura di una discussione, che appare ormai indispensabile per evitare nocivi arroccamenti 'specialistici' e per fondare su basi metodologicamente più solide l'impetuoso, necessario, ma talvolta eccessivamente autoreferenziale, sviluppo delle nuove metodologie di ricerca, illustrate nel presente volume.

Note

- 1 Ringrazio Simon Keay per avermi richiesto questo intervento, che mi ha imposto di riflettere in modo più organico su argomenti che rimuginavo da tempo.

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